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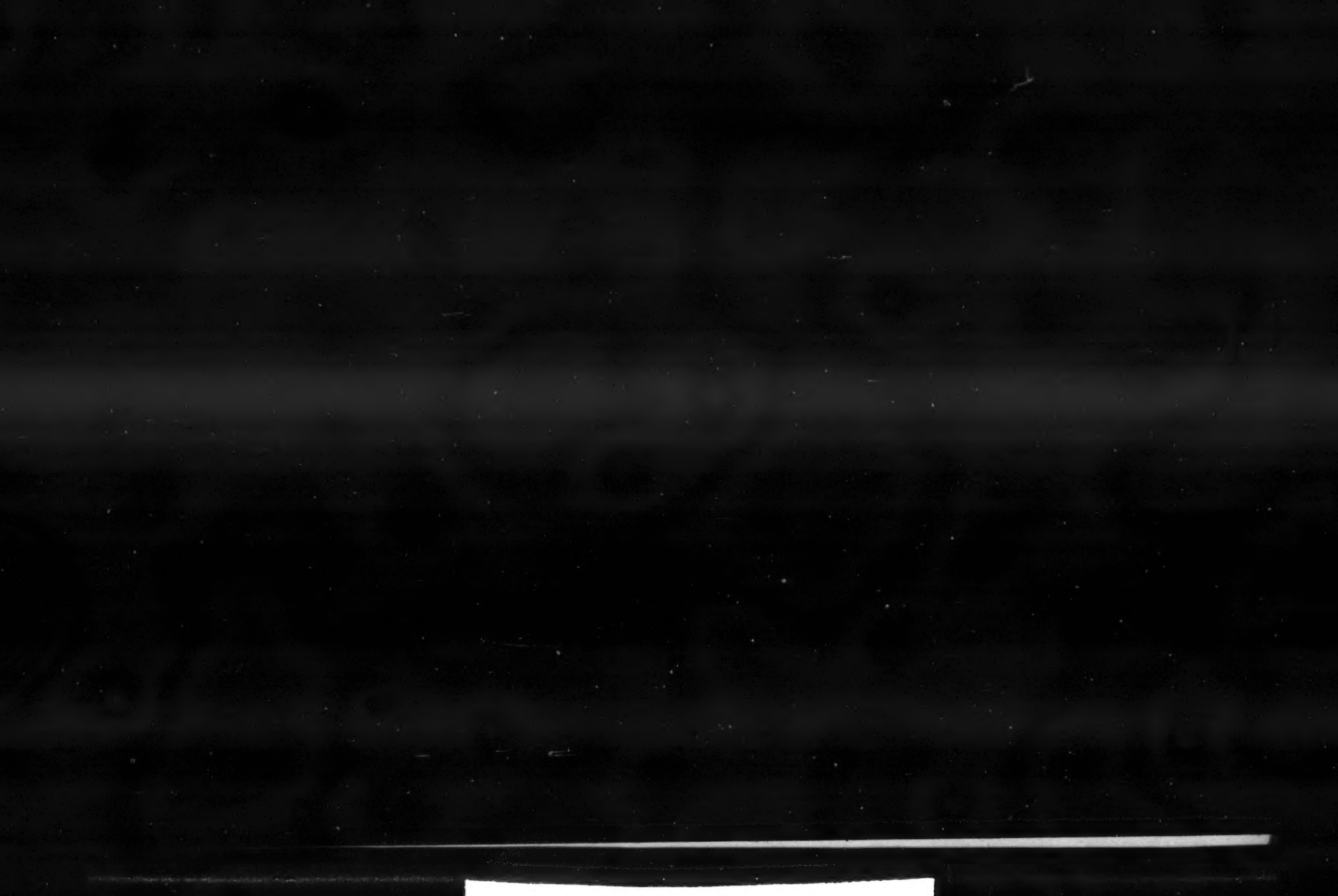

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Pneumonia-Enteritis Of The Newborn Calf: III. The Reproduction And Transmissibility Of The Disease†

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C. A. BRANDLY,** D.V.M., M.S.

In this, the concluding article of the series of three separate discussions, (see Veterinary Medicine, 49:512 [Dec.], 1954 and 50:63 [Feb.], 1955, the authors outline experimental evidence that in the pneumonia-scours complex of calves, particularly dairy calves, infections other than bacterial are of primary etiological significance. A virus etiology is tenable; however, the influence of extrinsic factors are noted, which supports the conclusion that a "factor," rather than micoorganisms is responsible for pathology observed commonly in the field. The exact classification of the non-bacterial disease-producing agent requires further definition.

THERE are numerous reports in the literature dealing with the etiology of apparently infectious disease or disease complexes among newborn calves in which diarrhea or pneumonia, or both, are predominant signs. Among the bacteria most commonly recovered, postmortem, from lungs of calves with pneumonia are: Pasteurella spp.,[3,25,26,27,29,43,44,50,54,65] *Clos. pyogenes*,[25,26,29,51,58,59,67] *E. coli*,[3,28,29,-59,59] paracolon,[25,29] cocci[3,59] and coccobacilli[29,61,64].

Bacteria, however, were not isolated from the pneumonic lungs of all calves.

Many investigators have tried to induce pneumonia experimentally by inoculation of calves with bacteria or tissue suspensions.

In the positive experimental trials with affected lung tissue, the primary symptoms were predominantly gastrointestinal; pulmonic involvement became apparent in the later stages of the disease.

Inoculum	Route	Result	Reference
Past. spp.	Intra., pulmonic	pos.	44,50
Past. spp.	Alimentary, trachea	neg.	8,54,55
Hem. influenzae	Intranasal	equi.	61,64
Lung extract	Trachea	pos.	8
Filtered lung suspensions	Intranasal	pos.	31
Filtered lung suspensions and nasal secretions	Intranasal and oral	neg.	54,55

The first bacteriological investigation of calf scours was that of Jensen in Denmark in

†This paper includes data and a report on work included in a thesis submitted by T. Moll to the Graduate School, University of Wisconsin in 1952 in partial fulfillment of the requirement of the Ph.D. degree. The work reported constitutes a part of project 565 of the Wisconsin Agricultural Experiment Station, the support of which was supplemented by funds from the National Institute of Health and from the Graduate School, University of Wisconsin. Published with the permission of the Director of Agricultural Experiment Station, University of Wisconsin, Madison, Wisconsin, as paper NS 156 of the Department of Veterinary Science.

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1891[25]. Since that time a number of workers have searched for the etiological agent of calf scours through bacteriological examination. A great many species of bacteria have been isolated from the blood and organs of calves with scours, but in most instances such procedures have been conducted after death. Among the bacteria most commonly associated with cases of calf scours are: *E. coli*,[5,14,15,16,17,24,28,29,30,35,39,42,43,44,47,49,50,54,58] paracolon,[6,21,22] Salmonella spp,[15,25,26,29,40,47,58,65] Pasteurella spp.,[5,15,27,32,40,43,44,47,50,55] cocci,[1,9,10,28,30,37,39,40,50,53,54,56] and coccobacilli[33].

Many of the investigators who have attached significance to the bacteriological findings have admitted that bacteria could not be isolated from all cases.

Lesage and Delmer,[32] and Hagan[22] were not able to isolate any bacteria from the blood streams of calves prior to the agonal stage of typical calf scours.

In cases where *E. coli* was not isolated or isolated only from the mesenteric lymph nodes, the disease and death have been attributed to an *E. coli* toxemia. *E. coli* endotoxins, when injected intravenously or subcutaneously, induce signs in young calves some of which are comparable to those of calf scours. However, such endotoxins do not appear to have any visible effect when introduced orally [33,51,57].

Jensen,[36,36] reported that he was able to reproduce colibacillosis experimentally in young calves by the administration of *E. coli* isolated from affected calves, *per os* or per rectum. Cultures of *E. coli* isolated from normal calves, when administered by the same routes, resulted in only transient and relatively mild diarrhea. Jensen also reported that he could reproduce "isocolibacillosis" in a proportion of his experimental calves by feeding isocolon bacilli.

Glanz,[21] reported reproduction of calf scours after feeding coliform organisms from affected calves, while Poels,[50] was able to induce only slight transient diarrhea in some young calves by feeding such microorganisms. Piana,[45] Lesage, and Delmer,[32] and Carpenter,[8] were not able to reproduce these results. McEwen,[35] fed large numbers of *E. coli* to newborn calves and was able only to produce scours in some that did not receive colostrum and only during certain periods of the year.

Christiansen,[16] found that small doses of paracolon bacilli administered subcutaneously or orally would result in fatal disease in calves three weeks to two months of age, and in a transient disease in adult cattle and horses when administered subcutaneously or intravenously. He also found diplococci to be highly virulent for newborn as well as older calves when administered orally or parenterally.

Baker,[3] Gallo *et al.*,[20] and Light and Hodes[31,32] have isolated filterable agents which produced pneumonia and enteritis in young calves.

This study represents an attempt to reproduce and transmit calf pneumonia-enteritis (CPE) with bacteria-free tissues of calves affected with the disease and by contact with diseased calves and contaminated premises and materials.

Materials and Methods

The sources of calves used in these experiments and the method of feeding, isolation and examination have been described in a preceding paper[43]. Blood and tissues of affected calves from three field outbreaks of CPE were employed. Only blood and tissue samples found to be free of bacteria by the methods used served as source material for inoculation. Blood samples as well as tissues were frozen shortly after they were obtained and examined and stored in sterile, sealed containers at a temperature of —10 to —15 C. Since the experiments were carried out over a long period, some materials were stored for periods up to six months.

Some of the experimental calves were exposed shortly after arrival at the experimental premises, while others were held for one to three days before exposure. Contact exposure was accomplished through direct contact with sick animals or uncleaned, contaminated pens.

Tissues were emulsified with 1% tryptone broth in quantities of 5 ml. per gm. of tissue. After grinding, the suspensions were centrifuged at 3000 r.p.m., for 15 minutes and the supernate decanted for use. Streptomycin and penicillin, when used, were added in amounts of 1 mg. and 1,000 international units (IU) per ml. of inoculum respectively. Blood was inoculated intravenously or intranasally; tissue suspensions were given intranasally. Intranasal inoculation was accomplished by means of a thick, soft, rubber tube attached to a syringe. The rubber tube was manipulated into the caudal turbinate region before the inoculum was released.

Blood was collected from living calves by jugular venipuncture. At necropsy, or immediately after death, blood was collected by cardiac puncture.

Blood samples were collected from control calves on the second, fourth, and sixth day

of life. Blood samples were drawn from the affected calves at comparable stages in the disease course. The stages selected were as follows: (1) At the estimated initial temperature peak, (2) at the second apparent temperature peak, (3) before general weakness and impending death, and (4) postmortem.

Blood samples were examined bacteriologically by direct plating and enrichment cultures. Bovine blood agar, eosinmethylene blue agar (EMB) and Salmonella-Shigella agar (SS) were used for plating. Enrichment cultures were made by mixing 10 to 15 ml. citrated blood with 100 ml. of 1% tryptone broth. The latter were incubated for 24 to 48 hours and then plated on agar media as used for direct cultures.

Spleen, liver, mesenteric lymph nodes, kidneys, and lungs were examined for the presence of bacteria by the same methods used for the blood. These organs also were cultured for anaerobic bacteria by employing Brewer's thioglycollate medium. Complete serological and biochemical identification of the microorganisms was not done.

Results

Control Calves. Seven calves less than three days of age, two of which did not receive colostrum, were placed in quarters which had been cleaned, disinfected, and left unpopulated for 14 to 30 days. They were introduced into such premises at various intervals during the experimental period as controls and as a test for possible residual infection. All control calves were raised successfully without showing any signs of disease.

Contact Exposure. Thirteen calves, less than three days of age, were exposed by contact. Ten of these did not receive colostrum, while three were allowed colostrum. All calves revealed the first signs of disease by temperature elevation or anorexia, or both, within 24 to 72 hours after exposure. Eleven developed acute CPE while two showed only mild abortive signs.

Simultaneous Intravenous and Intranasal Exposure. Thirteen colostrum-deprived calves, less than five days of age, were exposed. In these experiments one original strain was carried through six, the second through four, and the third through three calf passage. All calves manifested temperature elevation or anorexia within 12 to 120 hours after inoculation. Seven developed acute, one subacute, and five a mild, transient form of CPE.

Intravenous Inoculation. Four colostrum-deprived calves, less than three days of age, were inoculated intravenously with 10 to 15 ml. of citrated blood. All four developed first evidence of disease 24 to 36 hours after inoculation. Three contracted peracute CPE, while one presented clinical characteristics of subacute CPE.

Intranasal Inoculation. Four calves which were allowed colostrum during the first 24 to 48 hours of life were inoculated when less than three days of age. Two of these were inoculated with lung suspension. In one instance, streptomycin and penicillin had been added to the inoculum shortly before use. Both calves revealed pyrexia 30 to 48 hours after inoculation and developed the subacute form of CPE. Respiratory distress was observed in both cases during the later stages.

Two calves were inoculated with a mixed suspension of spleen, mesenteric lymph nodes, and intestinal mucosae, and again, streptomycin and penicillin were added to the inoculum administered to one of these calves. Temperature elevation was observed 48 to 60 hours after inoculation, and both calves developed subacute CPE.

Bacteriological Examination. Bacterial cultures of blood and organs of four apparently normal calves were negative except that the mesenteric lymph nodes of two calves yielded a few bacterial colonies.

With few exceptions, the direct blood cultures of affected calves collected before, during, or after the moribund stage were negative. A few of the enrichment blood cultures made before the moribund stage were positive for bacteria. During or after the moribund state the large majority of the enrichment blood cultures yielded bacteria, (table 1).

With the exception of the mesenteric lymph nodes, bacteria were seldom isolated from the organs of animals killed before general weakness had developed. Bacterial cultures from the mesenteric lymph nodes were positive in seven of nine such cases investigated (table 2).

The bacteria most commonly isolated from blood as well as organs were coliform organisms. Aerobacter species, cocci, and Gram-positive rods were isolated from organs in a few instances.

Discussion

Poor management and faulty and deficient diet may give rise to digestive disorders in young calves. Vitamin deficiency has been reported as a cause of calf scours[5,48] although several workers have been unable to correct the disorder by the use of vitamins[52,53,54,68,70].

Certain types, however, seem to occur under all conditions of managements and all methods of feeding, and ordinarily do not respond to changes or correction of diet and management. The epizootiological as well as the clinical and pathological features of many cases of calf scours and pneumonia also suggest an infection.

E. coli has been incriminated commonly as an etiological agent of calf scours. Definite morphological, physiological, and antigenic differences have not been established between types or forms of *E. coli* normally present in the gastrointestinal tract of newborn calves[9,15,88] and those isolated from calves with calf scours[71]. The serological types: $111:B_4$, $55:B_5$, $26:B_6$, and 86 of *E. coli* frequently have been found associated with infantile diarrhea, a disease resembling the calf scours syndrome[4,15,59,48,35]. Some investigators,[88] recognizing the pathogenic role of these coli types, have pointed out that other factors appear to be necessary for manifesting infection. The pathogenicity of these coli types for mice and calves did not differ from those normally found in these animal species[4].

Five-week-old calf exhibiting symptoms of marked depression, anorexia, dyspnea, and diarrhea, temperature was recorded as 106 F.

The presence of K-antigen in *E. coli* seems to be of considerable importance to the toxicity of these microorganisms, the K+ forms of a strain being more toxic than the corresponding K— forms[13]. Evidence also has been presented indicating that the protective power of colostrum against calf scours is correlated with the presence of K-antibodies against *E. coli*[86].

TABLE 1. Results of Bacterial Examination of Blood from Calves Affected with CPE

	Time of Cultivation	Type Culture	Peracute CPE Tot. no.	Peracute CPE No. +	Peracute CPE No. —	Acute frank CPE Tot. no.	Acute frank CPE No. +	Acute frank CPE No. —	Subacute frank CPE Tot. no.	Subacute frank CPE No. +	Subacute frank CPE No. —	Mild abortive Tot. no.	Mild abortive No. +	Mild abortive No. —	Inappar. sub. cl. Tot. no.	Inappar. sub. cl. No. +	Inappar. sub. cl. No. —
NON-COLOSTRUM FED CALVES	1st Temp. Elevation	D	6		6	19		19	4		4						
		E	6	1	5	19	1	18	4		4						
	2nd Temp. Elevation	D							4		4						
		E							4		4						
	After Development of Diarrhea	D				12		12	4		4						
		E				12	1	11	4	1	3						
	Before Weakness	D				6		6	4		4						
		E				6	1	5	4	1	3						
	Moribund	D	4	1	3	4	2	2									
		E	4	3	1	4	3	1									
	Dead	D	2	1	1	4	3	1									
		E	2	2		4	4										
COLOSTRUM FED CALVES	1st Temp. Elevation	D				2		2	5		5	2		2	2		2
		E				2		2	5		5	2		2	2		2
	2nd. Temp. Elevation	D							4		4	2		2	2		2
		E							4	1	3	2		2	2		2
	After Development of Diarrhea	D				1		1	4		4	2		2	2		2
		E				1		1	4	1	3	2		2	2		2
	Before Weakness	D				1		1	3		3				2		2
		E				1		1	3	1	2				2		2
	Moribund	D				2		2									
		E				2	1	1									
	Dead	D				2	1	1									
		E				2	1	1									

+ indicates bacteria present; — indicates bacteria not present; D indicates direct plate culture; E indicates enrichment culture.

Several types or forms of apparently infectious pneumonias and diarrhea of newborn calves have been distinguished in the past by bacteriological findings at the time of postmortem examination. In many instances, the calves had died after prolonged illness, during which secondary changes could have resulted from opportunal infection by normal inhabitants of the upper respiratory tract, the alimentary tract or by secondary exogenous infection.

Microorganisms present as part of the normal flora of the gastrointestinal tract and upper respiratory tract may enter and spread throughout the system when the local defense barriers are broken down and the body resistance is lowered during the terminal stages of disease.

In the present investigation bacteria could not be demonstrated in blood or organs of most affected calves before the moribund and terminal stages of CPE; but bacteria were isolated frequently from these sources after death. These results correspond closely to those of Lesage and Delmer,[23] and Hagan[24].

types of pneumonia and enteritis in young calves.

According to the available information one can conclude only that the nature of the disease or diseases under discussion remains obscure and the exact etiological aspects somewhat uncertain. The classification of calf diseases on a bacteriological basis is therefore, to be considered as somewhat premature and not fully dependable.

Generally, it may be said that certain bacteria cause primary pneumonia and diarrhea in calves under certain conditions, but in most such cases in young calves a nonbacterial factor appears to be primarily involved. This primary etiological factor and the disease-producing mechanism have not yet been defined.

Summary and Conclusions

1. Bacteria were rarely isolated from the blood or organs of calves affected by pneumonia-enteritis (CPE) when killed prior to the moribund stages.

2. The disease is infectious. The various clinical types of CPE were reproduced experimentally by contact exposure of susceptible newborn calves or by intravenous and intranasal inoculation with bacteria-free blood, suspensions of lung, spleen, mesenteric lymph nodes, and intestinal mucosae. This susceptibility to the disease seemed to decrease progressively during the first week of life of the calf. Consumption of colostrum by the newborn calf, likewise, seemed to reduce the susceptibility to, and alter favorably, the course of the disease syndrome.

3. The specific etiological relationship of a filterable factor to pneumonia-enteritis in newborn calves tends to further minimize the significance of postnatal, bacterial infection as a primary factor in the etiology of this disease as presently encountered on Wisconsin farms.

TABLE 2. Results of Bacterial Examination of Organs from Calves Affected with CPE

	Spleen			Lungs			Mes. L. Nodes			Kidneys			Liver		
	Tot. No.	No. +	No. —	Tot. No.	No. +	No. —	Tot. No.	No. +	No. —	Tot. No.	No. +	No. —	Tot. No.	No. +	No. —
Killed before weak	10		10	5	0	5	9	7	2	2	0	2	6	1	5
Killed moribund	4	3	1	1	1	0	2	1	1				1	1	0
After natural death	3	3	0	1	1	0	5	5	0	2	2	0	1	1	0

+ indicates bacteria present; — indicates bacteria not present.

The fact that bacteria could not be isolated from organs of some frank cases of pneumonia or diarrhea in young calves, especially from those of short duration, supports the assumption that bacteria isolated from other cases may be secondary invaders. Such negative findings, together with the great diversity of bacterial species, tend to minimize their primary importance.

The disease was reproduced in its different forms by intranasal or intravenous inoculation, or both, of blood and organ suspensions of affected animals from which bacteria could not be isolated.

The nature of the nonbacterial factor or factors was not determined in these experiments. Whether the blood and tissues contained an infectious agent or acted as a "jolting" or "trigger" factor remains an open question.

The findings of Baker,[3] and others,[20,33,34] suggest a virus as the primary agent in certain

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Differential Diagnosis Of Certain Septicemic Diseases Of Swine

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In outlining the contents of this article, the author pointed out that it is essentially a discussion of fundamentals with which those engaged in extensive swine practice are familiar. Puzzling problems that challenge the best informed, however, do occur frequently and basic manifestation of various diseases must be kept in mind constantly. Furthermore, these entities appear to change or deviate from the expected, thus occasionally throwing the best intended effort toward classification off balance.

Swine raising is extending into new areas and concentrations are posing problems new to local practitioners. The factual nature of this article, as swine disease is observed in the hog lot, should prove especially valuable to those who are being called upon more frequently for professional service to new swine growers.

DIFFERENTIAL diagnosis of infectious and contagious diseases of swine presents one of the most difficult problems in general practice.

The one crystal-clear lesson that I learned early in my years of contact with swine diseases is that there is no place for hair-splitting differential diagnosis in droves of swine that have not been properly immunized against hog cholera. Disregard of this long-established rule has been responsible for loss of countless thousands of swine that might otherwise have been salvaged by quick blanketing with serum or with serum and virus.

It may be said that any drove of swine with a history of open susceptibility, with evidence of fever, and with presence of septicemic lesions merits an immediate, presumptive diagnosis of hog cholera.

On the other hand, a conclusive diagnosis of hog cholera in swine with a history of prior vaccination, either with serum and virus or any of the federally-licensed cholera vaccines, is hedged about with extreme difficulty.

In droves with so-called "serum breaks" (6 to 14 day trouble) identification of the complicating factor or factors responsible is the all-important consideration. In such instances, where over-reactions have occurred, the virus lesions of cholera are always present, provided virulent virus was injected at time of vaccination. The difficult problem comes when one attempts to sift out and interpret the complicating lesions that overlie the primary, septicemic lesions produced by hog cholera virus.

In the so-called "virus breaks" (those occurring later than three weeks after injection of serum and virus or hog cholera vaccines) it must be kept in mind always, as shown by Seghetty, Schofield, Pinkerton and many others, that *Salmonella cholerasuis* can produce microscopic symptoms and a lesions picture, either primary or secondary, that is indistinguishable from hog cholera. Furthermore, virulent strains of porcine Pasteurella, the swine erysipelas bacillus, and streptococci can, and often do, produce a febrile, septicemic picture which would justify, in unvaccinated herds, an immediate, presumptive diagnosis of hog cholera.

Snap Diagnosis Wrong

This, in turn, emphasizes the fact that one of the meanest "below-the-belt" breach of ethics that a practitioner can commit against a colleague is, either through ignorance, intent, or both, to make a snap judgment diagnosis of hog cholera in a drove that has been vaccinated previously by another veterinarian. This is equally true of the college laboratory diagnostician who presumes to diagnose hog cholera by autopsy alone on vaccinated pigs submitted by clients of a licensed practitioner.

It can be stated undebatably that the only final and totally conclusive diagnosis of hog cholera in pigs vaccinated more than three weeks is by filtration of blood or spleen pulp to remove all bacterial pathogens; the injection of this filtrate into a group of known susceptible pigs in proper isolation and in contact with two or more uninjected control pigs. Pigs so challenged must develop typical symptoms and lesions of hog cholera within the prescribed incubation period. In a court of law, this is the only diagnosis of cholera in long-time vaccinated pigs that will stand under cross examination.

On the other hand, whether one encounters a so-called virus break in his own practice, or in consultation with the veterinarian or farmer who did the original vaccinating, revaccination is entirely justified if the history, symptoms, and lesions are characteristic of those noted in uncomplicated hog cholera of open herds. Some recent research adds weight to this postulate, for it appears that swine vaccinated with potent serum and virus or vaccines may "break" if they are later exposed to virulent field strains of variant virus.

Hog Cholera per se

Now, for purposes of review (for we are dealing with matters of common knowledge) let us discuss briefly the field picture of three common contagious swine diseases.

Often in primary hog cholera one can disclose a history which includes the story of loss of one or more pigs up to three weeks prior to the appearance of a spreading herd sickness.

When we enter the hog house we note a variable number of the animals well hidden in the bedding. Temperatures of many of these sick pigs are noted to reveal a fever ranging from 105 to 106 F. Eyelids are gummed with exudate. We run all pigs that can be kicked up, or that are on their feet, out into the yard toward the feed troughs. Some of the sick ones sway drunkenly in the hind quarters. They go to the troughs and may nibble a little, then turn away and stand in the typical "thinker" or so-called "looking-for-diamonds" attitude. Some of the pigs may show an "easy-running" black diarrhea and one or more may be observed in a strychnine-like, convulsive, teeth-champing fit.

History and observation discloses that spread of the sickness has been progressive and steady with additional pigs slowing up and sickening from the day the owner noticed the first sick pigs. Then, among other things, we note no constancy of coughing or distinctive respiratory symptoms, no evidence of bloody diarrhea, no leads or hints of poisoning as the cause of the herd sickness.

A careful selection is made of never less than two of the more advanced typical pigs, or, in lieu of these, two or more pigs that have died within the hour, or that are moribund. Proceeding with autopsy, hyperemia of the belly is checked, as is evidence of arthritis, presence or absence of pox lesions or the rhomboid skin lesions sometimes noted in erysipelas. Almost automatically a mental note is made of the plentitude of lice or the presence of mange lesions.

In our autopsy to establish a diagnosis of hog cholera we often find that the sparsity or near absence of lesions is especially significant. For, as the late Dr. A. T. Kinsley so aptly stated: "Acute hog cholera can often be a lesionless disease."

We note that the cervical, crural, mediastinal, and mesenteric lymph glands, when sliced, reveal a deep red outer zone margin of profound congestion, with a dimmer red spotting of the parenchyma, the "strawberry" gland. We notice the spleen is a little darker and often slightly larger than normal. When we find them, one or more darker-colored ovoid splenic infarcts are significant. The kidney capsule appears tight and the uncut kidney may reveal very few to many extremely tiny, petechial hemorrhages. We slice the kidney and note a variable number of fine petechiae on the congested cut surface.

Likewise, we may note fine petechiation of the mucosae of the urinary and gall bladders, on the membrane of the epiglottis and on the exposed parietal surfaces of the lungs, which normally feature a dim, hyperemic blush. The

Numerous factors contribute to causes of baby pig losses. Proper management and adequate nutrition of the brood sow during gestation are of vital importance in production of large, husky litters.

liver usually shows no gross change other than diffuse areas of congestion. Tiny petechiae may be noted on the intestinal serosa while the enteric mucosa, especially the colon, evidences a red blush, but without surface necrosis. The myocardium is usually clean of hemorrhages except on the white coronary band or the aortic arch. In subacute cases, the presence of small, distinct, button ulcers of the colon are significant.

Usually Atypical

The foregoing is the typical picture of "simon-pure", uncomplicated hog cholera. Unfortunately, not too many of these wholly typical lesions occur in field outbreaks. The reason is that, as in many other virus diseases, a distinct leukopenia occurs early and the gates are opened for blood and tissue invasion by bacterial pathogens. Chief among these is *Salmonella cholerasuis*, a readily facultative pathogen commonly present in the gut of normal swine.

A primary septicemia producer in its own right, *Sal. cholerasuis* overlies the minute petechiae of cholera by more abundant and pronounced petechial and ecchymotic hemorrhages. In cholera complicated by Salmonella, some lymph glands show typical marginal congestion while others, especially the mesenterics and mediastinal, may be grossly enlarged and, when sliced, are a deep black-red throughout. In addition, we note a much enlarged and darkened spleen and a greater plentitude of myocardial, epicardial, and endocardial hemorrhages. Commonly, a deep rosy-red gastritis is observed and an active enteritis having increasing intensity from the duodenum to, and throughout, the colon. In a high percentage of subacute cholera cases, compounded with virulent Salmonella infection, we note fibrinous pleuritis and odorous lobar pneumonia.

Primary, acute salmonellosis of swine is featured by a marked leukocytosis, whereas in primary hog cholera we have a quite constant and marked leukopenia. Another point is that in acute salmonellosis pigs do not exhibit the extreme depression noted in hog cholera and will often eat freely even with a temperature above 106 F.

A full discussion of porcine salmonellosis is beyond the scope of this paper but, in weanlings and shote-age pigs "straight" Salmonella infection can produce spotty death losses by acute septicemia, subacute losses by a hot enteritis and its chronic form, a necrotic enteritis, and necrotic pneumonia.

Erysipelas

What are the points of diagnostic significance between hog cholera and swine erysipelas?

In acute erysipelas, one rarely gets a history of a "seeder pig" death three weeks prior to appearance of drove sickness. Commonly, the owner may find one or several pigs dead without any history of previous illness.

Here, too, we find sick shotes hiding in the bedding with temperatures ranging from 105 to 108 F. However, eyes are clear and alert. Pull them up by the tail and some may squeal with pain. They stand with bunched feet like a foundered horse or, sometimes, they are up on their toes more than normal. Run them around and they seem to warm out of their stiffness and move more freely. Loss of appetite usually is complete. Run your finger tips down the back and sides and you may note variable sized, flat, urticarial spots. Inspect all the shotes in the drove and you may see an enlarged joint here, curled ear there, a dried up tail, a livid red blush of the inner front legs and thorax, or the presence of the rhomboid red spots to purplish-red spots of diamond skin disease on the inner thigh surfaces or belly. Occasionally one may notice a single, chronic case in an acutely sick drove exhibiting skin slough.

In a non-immune herd, I have never been able to differentiate erysipelas from hog cholera on the basis of lesions alone. In erysipelas, an excess of slightly reddish pericardial fluid may be differentiating. Kidneys may show cloudy swelling and either petechiae or ecchymoses, or both. The glomeruli are usually a very deep red. The heart may be covered with small hemorrhages and rarely are we lucky enough to find cauliflower growths on the heart valves. The pleural wall may be a deep, solid, congestive red (so-called bloody imbibition). The spleen usually appears quite normal in size and color but with reddened margins and without the infarcts noted in cholera. A paint brush hemorrhage lesion along the greater curvature of the stomach is a typical lesion, when present, but we do not see them as often as some authors have inferred.

In uncomplicated erysipelas, the gastrointestinal mucosa is red and congested, but not actively inflammed and the washed mucosa is pin-pointed with many petechial hemorrhages. The lymph glands in erysipelas are moderately enlarged, uniformly congested and best described as "juicy." The lungs are sometimes

livid red and congested with liberal sprinkling of variable sized hemorrhages. But, here again, the peracute erysipelas pig may die so quickly that the tissues are almost lesionless. Laboratory confirmation and a check test by giving two or more sick pigs a heavy intraperitoneal dose of erysipelas antiserum are doubtless the two most valuable assets in hitting a specifically-correct diagnosis of erysipelas.

Swine Plague

A quarter century ago, veterinarians tended strongly toward a diagnosis of swine plague or hemorrhagic septicemia in swine. Then the pendulum swung the other way and some speakers and teachers stated that swine plague or porcine pasteurellosis exists only in the minds of bacterin makers. The right premise is somewhere about half way between these two view-points. It has been my observation that normal swine, under good conditions of sanitation and feeding, rarely sicken or die from swine plague. On the other hand, droves that have been depleted by the leukopenia of cholera vaccination, sapped by parasites, exposed to swine flu, or that are weakened by being roughly handled at sales barns may die from *Pasteurella suisepticus* infection.

Here is an organism that is present almost constantly in the dust of hog yards and in the respiratory tracts of normal swine. When resistance hits a low ebb it can flare and kill either by acute septicemia or by a rather typical, marbled type of lobar pneumonia or both. So far as I know, there are no marked, distinguishable differences between the septicemia of hog cholera, salmonellosis, and swine plague. However, in the latter disease, there is an inclination to a greater incidence of pneumonia and myocardial hemorrhages. Whenever possible it is good policy to let the final diagnostic decision rest on the findings of a good laboratory.

Conclusion

In the foregoing, effort has been made to picture symptoms and lesions associated with the so-called "big-three" swine contagions, cholera, salmonellosis, and erysipelas as they have been observed in the field. A number of others may pose problems or complicate differential diagnosis.

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Parasitologists at the government's Beltsville station have succeeded in infecting swine with kidney worms (*Stephenuris dentatus*) by feeding earthworms carrying infective larvae.

Pneumonia-Enteritis of Calves

(Continued from page 106)

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(Continued on page 113)

Comparison Of Vehicles In Intramammary Therapy Of Bovine Mastitis†

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WITH the introduction of antibiotics in veterinary therapy, extensive interest has developed in vehicles and antibiotic dosages for intramammary administration in the treatment of bovine mastitis.

Various phases of this problem have been investigated, *i.e.*, various vehicles, quantity of vehicles, various antibiotics, and antibiotic dosages. No attempt will be made to elaborate on the results of these investigations, as the method of evaluation has, in general, been quite varied. Generally, however, the means of evaluating antibiotics following intramammary administration has been based on persistence of antibiotic levels in milk following administration.

This investigation has been an attempt to compare the two general types of vehicles most widely employed, *i.e.*, ointments and aqueous solutions, on the basis of intramammary penetration as determined by assay of mammary tissue from various areas throughout the infused quarter.

Methods and Materials

Antibiotics employed in this experiment included aureomycin,[6a] terramycin,[6a] penicillin, and streptomycin**. Vehicles employed were of two general categories; namely, ointment (7.5 gm.—1 quarter) and sterile distilled water (500 cc.—1 quarter) preparations. Antibiotics were administered in equal quantities in each vehicle. Each vehicle was infused into one rear and one front quarter of each half of the udder. At a designated postadministration period, the experimental animal was slaughtered and the mammary gland removed. The gland was attached to wire supports to effect most nearly obtainable normal position and form. The suspended gland was placed in a freezing compartment where the temperature was held at —4 F. When completely frozen, (after 24-36 hours), sections of tissue were removed with a one inch auger. The tissue was added to equal parts (by weight) of sterile, distilled water and macerated in a kitchen blender. The macerated material then was frozen until assayed. The methylene-blue milk method of assay was employed[1].

Results

In general, the results of this investigation indicated a more uniform distribution of antibiotics throughout the infused quarters with the aqueous solution, as compared with various commercial ointment preparations. The results of this investigation appear in fig. 1. The quarters designated as non-mastic were quarters showing no abnormal secretions, as based on a strip-cup examination, and no swelling upon manual palpation. Those quarters designated as mildly mastitic presented evidence of clinical mastitis through secretions having various-sized clots, varying degrees of "thick milk" and mild glandular swelling. The acutely mastitic glands gave evidence of extensive, purulent, inspissate secretions, extensive glandular swelling, and hardness.

Non-Mastitic Quarters

The concentrations of antibiotics in aqueous vehicles present in the upper third of the infused quarter varied from a high of 10-27 to a low of 3-5.4 micrograms per milliliter. The antibiotic concentrations in ointment preparations, in a generally-same area, varied from a high of 1.2-2.0 to a low of 0-1.0 micrograms per milliliter.

†Preliminary investigation of this problem was carried out by the author at the Dairy Division, University of Minnesota, St. Paul, Minnesota. The author wishes to express his gratitude to Dr. B. S. Pomeroy, Department of Veterinary Medicine and to Dr. W. E. Petersen, Department of Dairy Husbandry, University of Minnesota, St. Paul, for their guidance and encouragement in the preliminary investigation.

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*Department of Veterinary Science, North Dakota College of Agriculture.

**Terramycin supplied by Dr. Gail Hawley, Chas. Pfizer and Co., Inc., Brooklyn, N. Y. Aureomycin supplied by Dr. Lawrence W. Price, Lederle Laboratories, Div., American Cyanamid Co., Pearl River, N. Y. Penicillin and streptomycin supplied by Dr. Laurent Michaud, Merck and Co., Rahway, N. J.

[6a]Lederle Laboratories Division, Pearl River, N. Y.

[6a]Chas. Pfizer & Co., Brooklyn, N. Y.

Concentrations of antibiotics in aqueous solutions in the middle third of the infused gland presented a high of 27-57 with a low of 5.4-7.5 micrograms per milliliter. The antibiotic concentration in the ointment vehicle varied from a high of 2.0 to approximately 200 with a low of 1-3 micrograms per milliliter.

Samples from the lower third of the infused quarters indicated the greatest variation in concentration of antibiotics. The aqueous preparation presented a high of 57-89 with a low of 7.5-9.3 micrograms per milliliter. The ointment preparation indicated a still greater variation of antibiotic levels with a high of over 200 to a low of 3 to approximately 200 micrograms per milliliter.

A total of 37 quarters were utilized in this phase of the experiment.

Mildly Mastitic Quarters

In general, the results obtained upon assay of tissue preparations from various levels of the infused quarters exhibiting mild mastitis were similar to those obtained from the mastitis-free quarters. A total of 18 quarters were utilized in this phase of the experiment.

Acutely Mastitic Quarters

Only 11 quarters were obtainable for this phase of the experiment. As evidenced in fig. 1, the greatest contrast in ability of the vehicles utilized to penetrate the mammary gland uniformly was detected in the acutely mastitic quarters. Generally, however, the same graphic conditions exist as demonstrated for the normal and mildly mastitic glands. Particularly evident is the higher concentration of antibiotic in the upper and middle portions of the gland when administered in the aqueous vehicle as compared with the ointment vehicle. A portion of this difference may have been due to the larger quantity employed in the case of the aqueous vehicle.

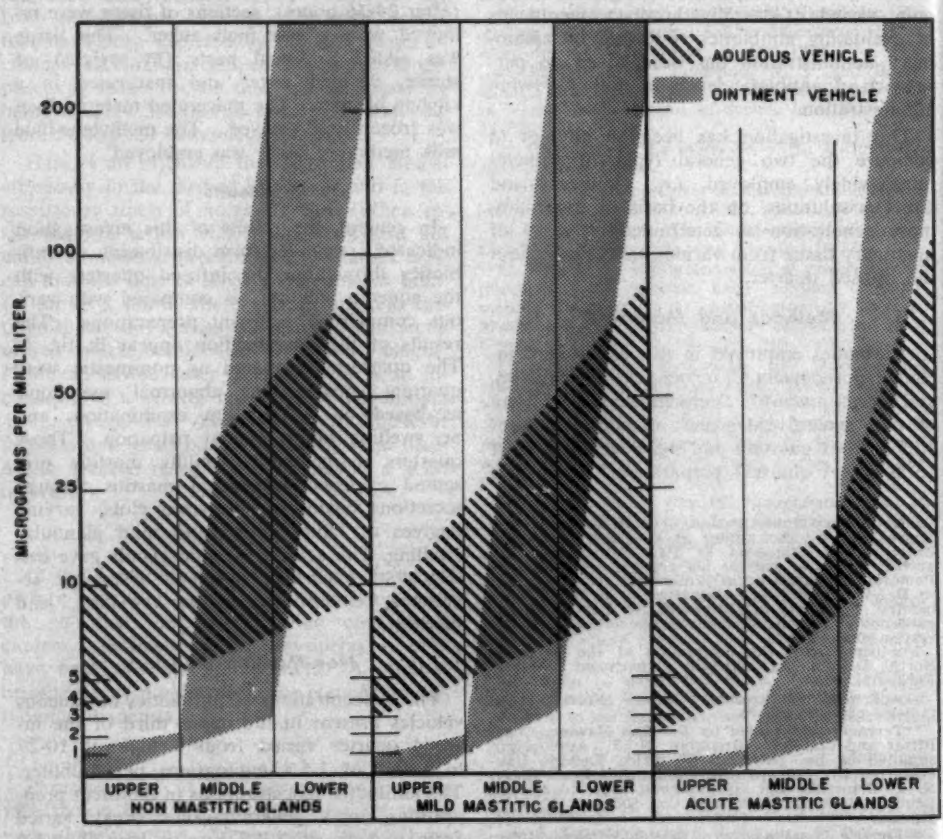

Fig. 1. Comparison of antibiotic levels in nonmastitic and mastitic quarters 24 hours following administration of 400 mg. antibiotic in ointment and aqueous vehicles.

Discussion

The more uniform distribution of antibiotic throughout the mammary gland, when aqueous vehicles were employed, is indicated from the data obtained in this investigation. In some instances, massive quantities of the ointment vehicle were found adhered to the teat wall 24 hours following administration. Massaging of the infused quarter immediately after administration of ointment preparations gave no indication of aiding penetration throughout the mammary gland. In one instance, quantities of antibiotic in ointment was found in the outpocketings of the lower mammary gland tissue six weeks following administration. The udder involved in this particular case was extremely large and pendulous.

The variation in antibiotic concentrations at various levels of the udder for either vehicle, may be due in part to the variation in the size of the udders available for investigation as well as the quantity of milk produced per quarter. At no time during this investigation was difficulty encountered in infusing 500 cc. aqueous vehicle per quarter. In some instances, difficulty has been encountered when infusing a like quantity of aqueous vehicle in the treatment of cases of mastitis. The utilization of large quantities of vehicle apparently are necessary to obtain maximum diffusion of available antibiotic into the upper third of the mammary parenchyma. This has become particularly evident when oxytocin was utilized previous to intramammary infusion as a means of eliminating the purulent secretions and bacteria present within the involved area[4].

Often, little or no antibiotic could be detected in the upper third of the mammary gland of acute mastitic glands when administered in the ointment vehicle. When detected in these areas, they were in the lowest ranges of chemotherapeutic value for mastitic organism. When antibiotics were administered in the aqueous vehicle, some variations of concentration in the upper third of the mammary gland was detected, but in general they were within the average chemotherapeutic range for organisms commonly incriminated as the causative agents of bovine mastitis.

Summary

1. The intramammary administration of chemotherapeutic agents in aqueous vehicles provides a uniform penetration throughout the entire quarter of the mammary gland.

2. The more uniform penetration of chemotherapeutic agents in aqueous solutions becomes particularly evident in acute mastitic quarters.

3. Massaging of the teat and lower udder following intramammary administration of ointment preparations gave no evidence of increased penetration.

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The common notion that swine can select a balanced ration when self-fed that will promote maximum gains does not agree with conclusions of some research workers. Michigan scientists have demonstrated that runt pigs gained substantially more per feed unit when fed a complete ration than when access was allowed to the same ingredients as grain and supplement.

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The flying fox, the largest of the bats, has a wingspread of five feet.—*S.N.L. Jan. 22, 1955.*

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Pneumonia-Enteritis in Calves

(Continued from page 110)

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Therapeutic Notes From Cattle Practice†

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FIVE years of veterinary service to the University of Connecticut herds has provided a number of experiences with the more common diseases of cattle and an opportunity to test various therapeutic agents. This paper has been prepared in the hope that some experiences will be of interest, if not of value, to practitioners. Ketosis, infectious pododermatitis, the calf scour complex, mastitis, and reproductive disorders have been most prevalent problems.

Ketosis

The most troublesome disorder of apparently metabolic origin with which we have had to deal is ketosis. Sixty cases were treated during the period covered by this report. Early in our experience with this disease it was possible to confirm the belief that mortality is not associated with simple ketosis. Animals which did not respond to therapy always revealed some complicating factor on exhaustive examination or autopsy. The complicating factor observed most frequently was nephritis and this, in all cases, a subclinical pyelonephritis as confirmed by bacteriologic and histopathologic means. Ketotic cows, apparently without complications, always responded, though sometimes slowly, to intravenous glucose therapy.

More rapid response was observed when glucose therapy was supplemented by the oral administration of choline chloride at the dose rate of 1 gm. twice daily. From 12 cases that were treated in this manner and that had been slow to respond to glucose, it appears that choline chloride was a valuable adjunct. Since choline, a member of the vitamin B complex family possesses a lipotropic factor, it may be that it served to accelerate fat metabolism, thus improving the therapeutic efficacy of glucose by clearing the so-called "fatty liver" usually associated with ketosis. Later a product, methiscol®[1], containing methionine, inositol, and choline, in syrup form, was provided for trial. This product when fed or administered at the rate of 6 oz. daily appeared to produce the same additive affect to glucose therapy as did choline chloride alone. Neither choline chloride alone nor the compound was, in itself, a successful therapeutic agent.

It is of interest that three out of five cases which had not responded after three days on glucose therapy did recover after treatment with 1 or 2 gm. of cortisone acetate (cortone)®[2]. Of the two which did not respond, one was found to be suffering from pyelonephritis and the other from lymphomatosis.

Four of five cases of ketosis responded to treatment with 1 or 2 gm. of cortisone (cortone)®[2]. Of the two which did not respond, Upjohn) as the sole therapeutic agent. One animal which showed no response after treatment with 3 gm. was found later to be suffering from pyelonephritis.

Comment. Glucose, glucose plus choline chloride, glucose plus cortisone or cortisone alone have all been effective therapeutic agents in the treatment of ketosis. Since response to cortisone therapy tends to confirm the diagnosis of ketosis, response failure after a dosage of up to 1 gm. daily for two days always should be followed by a more thorough clinical and clinicopathological examination to uncover any complicating factors. It may be wise to combine glucose and cortisone therapy for best results. Adrenocorticophic hormone (ACTH Armour) has been used on three cases with favorable results. The fact that ACTH effects recovery suggests that the syndrome may not be solely the result of adrenal lesions.

Infectious Pododermatitis

The herd veterinarian at the University has an advantage over the average practitioner handling the problem of infectious pododermatitis (foot rot). Animals are observed by many people at frequent intervals so that, with the exception of an occasional heifer on summer pasture, foot rot cases usually are

†Presented by the senior author at the annual meeting of the Florida State Veterinary Medical Association, St. Petersburg, October 17-19, 1954.

*Department of Animal Diseases, Storrs Agricultural Experiment Station, University of Connecticut, Storrs.

®[1]U. S. Vitamin Corp., New York, N. Y.
®[2]Merck and Co., Rahway, N. J.
*Supplied by David Yellen Co., Canton, Mass.

reported within a matter of hours after the animal takes the first abnormal "ouchy" step. The favorable response of these early-observed and treated cases to intravenous therapy has made it unnecessary to pick up the leg of any animal except for making a diagnosis in all but two of 97 cases.

Six to 18 animals were treated intravenously with solutions of each of the following listed products:

1. Sodium sulfamerazine, (500 cc.—12%)
2. Sodium sulfamethazine (sulmet)[3] (250 cc. — 25%)
3. Sulfamerazine and sulfamethazine (merameth)[4] (500 cc. — 5% each)
4. Sodium sulfapyridine, (60 grams)
5. Chlortetracycline (aureomycin)[3] (2.5 gm.)
6. Tetracycline hydrochloride (polyotic)[3] (2.5 gm.)

Recently intramuscular injection of penicillin, (1,000,000 units delayed absorption type) and tetracycline, (500 mg. repeated in 24 hours) have been employed.

Of the eight compounds used in the treatment of foot rot, all can be classified as effective. Only sulfamerazine or penicillin gave discouraging results. Sulfamerazine had the greatest number of response failures with about a quarter of the cases requiring retreatment with another drug. Only one complete failure was associated with penicillin therapy, however over 25% of the cases required retreatment after several days. All the other compounds used were effective with only an occasional relapse.

Comment. We did not experience as high a degree of success with penicillin as has been reported by others. Since the causative agent *Spheropherous necrophorus* is Gram-negative, this was not surprising. We can not help but feel that the effect of intramuscular penicillin is merely temporary, relieving symptoms in cases of mixed infection, but not leading to total recovery. The use of intramuscular tetracycline shows considerable promise but is in need of further study to determine the best dosage system. We feel that the dosage used will need to be increased both in the case of large cows and in attempts to make a single dose effective.

The Calf Scour Complex

In the main dairy herd at the University, the problem of scours is rare. Fortunately or unfortunately, depending upon your point of view, there is another large group of calves which is maintained for nutritional studies under separate and somewhat crowded conditions. Within this latter group of calves, scouring is common. During the past three years, 176 cases were treated identically to avoid influencing the experiments in progress. Of these, only three required additional therapy. Treatment was based on the weight of the animal and consisted of intravenous administration of sodium sulfamethazine at the rate of 1 gr. per lb. body weight, followed by sulfamethazine orally in three divided doses. Oral treatment consisted of 1 gr. per lb. for the first 24 hours, 1 gr. per lb. for the second 24 hours and 0.5 gr. per lb. for the third 24 hours, following the initial intravenous treatment. In the main herd, the same treatment was used for sporadic cases which occurred there.

The administration of one 250 mg. tablet or capsule of chlortetracycline every 12 hours for three days also has proved effective. This treatment now is used prophylactically on all calves entering the nutrition research herd.

Comment. The use of intravenous sodium sulfamethazine in the treatment of calf scours is highly effective as well as constituting a professional approach to the problem. Cases that occurred during the first 48 hours after calving often were found to be refractory to treatment. Upon autopsy, the two most common findings in such cases were purulent encephalomeningitis and leptospirosis.

Mastitis

Mastitis is an important cause of reduced milk production, lessened milk quality, and decreased longevity in cattle. *Streptococcus agalactiae* is the principal etiologic agent of this disease. Mastitis caused by *Str. agalactiae* (agalactiosis) is a highly contagious disease. Fortunately agalactiosis is one contagion which is eradicable by application of presently known methods.

Connecticut is one of few states where there is in existence a functional mastitis control program beamed toward the eventual eradication of agalactiosis. Upon written application to the state veterinarian and agreement to comply with certain sound management recommendations, any farmer may, at state expense, receive quarterly laboratory examinations of milk from every cow in his herd. The laboratory test employed utilizes the leukocyte count, as an indicator of the presence or ab-

[3] Lederle Laboratories Division, Pearl River, N. Y.
[4] Sharpe and Dohme (Div. of Merck & Co.), Philadelphia, Pa.

sence of inflammation, and identification of the causative organism by cultural methods for final classification.

Since it began in 1940, the program has developed to the extent that, in 1953, 35% of the dairy cattle herds in the state were entered in the program. Herd owners, in cooperation with practitioners making use of the laboratory reports, have been so successful in their fight that 60% of those herds on test by mid-1954 were free of agalactiosis, and had been, for from one to 13 years.

Eradication was accomplished by instituting sound sanitary stabling and milking practices with the simultaneous use of known effective therapy. Treatment was carried out on a test, treat, retest, retreat, et cetera, system of attack until the organism had been eliminated from a herd. In some herds it was necessary to sacrifice from one to three animals which failed to respond to therapy before the program in that herd could be brought to a successful conclusion. Failure to eliminate the cow that did not respond to treatment, failure to test fresh cows before returning them to the herd, and failure to treat the last few infected quarters because no "garget" was noticed has nearly always been followed by a high percentage of animals returning to an infected status, as observed on subsequent test. Once eradicated, agalactiosis has not returned except via purchased replacements or other mechanical carriers.

In herds where agalactiosis is absent initially or has been eradicated, the most serious problems result from micrococcosis and the all-too-frequent bouts with systemic mastitis.

Systemic Mastitis. By systemic mastitis, reference is made to cases characterized by fever and its companion symptoms, plus udder involvement. This may vary from a hard, painful swelling to no swelling whatsoever, with only the milk appearing abnormal. Formerly, systemic mastitis frequently was followed by death, gangrenous infections, or total loss of productivity from the involved quarter or quarters. Early detection with immediate therapy plus a confirming laboratory diagnosis in each of 49 cases resulted in only one death, no gangrene, not a single quarter lost, and little loss from the expected milk production of the animal even during the concurrent lactation.

Any animal in the herd which refused a meal or exhibited any other abnormality was immediately temperatured by the herdsman. A temperature of 103.5 F. with a swollen quarter or a temperature of 104 F. with an abnormal secretion on black plate examination (strip cup) was considered cause for the herdsman to call the veterinarian.

Treatment. Upon arrival, a thorough examination was made. The first thing done in all cases was to collect quarter milk samples for bacteriologic examination. After placing the animal in a well-bedded box stall, routine therapy consisting of the intravenous administration of 250 cc. of a 25% solution of sodium sulfamethazine was given. If severe quarter swelling was noted, hot and cold compresses were advised. After leaving the case, the milk samples were taken to the laboratory where they were streaked on blood agar and then given over to routine testing procedures.

Each case was revisited in from six to 12 hours. If an appreciable reduction in temperature had occurred, sulfamethazine orally at the rate of 30 gm. twice daily for two days and 15 gm. twice daily for the third day was prescribed. A slight temperature reduction called for a second intravenous treatment while no reduction or an increase in temperature was followed by a visit to the laboratory to see if anything had grown on the culture plate. Often it was possible to make a diagnosis from a strained milk film, a simple procedure within the reach of most practitioners. It is the writer's opinion that a bacteriologic diagnosis is as essential to the adequate treatment of

Comfort-stall dairy barn in Connecticut. Note retainer curbs for bedding and the chain-tie stanchions. Stalls are 4 ft. x 6 ft. 3 in. No swollen hocks, knees, or udder injuries occurred during the first winter of use.

systemic mastitis as it is to a mastitis control program or quarter treatment.

Eighty per cent of systemic cases responded to routine sulfamethazine therapy as described. Three nonresponding cases, caused by micrococcic infection, recovered following treatment with 2.5 gm. of chlortetracycline twice daily up to *at least* 24 hours following apparent return to normal. A fourth nonresponding micrococcic case recovered rapidly following treatment with 500 mg. of tetracycline intramuscularly twice daily and continued as just mentioned. In a large cow, it probably would be advisable to double this dose. Six systemic coliform cases which were refractory to sulfamethazine therapy all responded to intramuscular treatment with streptomycin at the rate of 2 to 5 gm. once or twice daily depending on size of the animal and severity of the case. Several Connecticut practitioners now are using this treatment routinely in slow-responding cases. In all cases, as soon as the udder was pliable enough to receive it, appropriate quarter infusion based upon laboratory report was applied.

It is of interest to note that on several occasions, we have isolated coliform organisms from the milk of sows suffering from postpartum mastitis and such cases also responded to streptomycin treatment.

Intramammary Therapy. Many products have been tested in cooperation with practitioners under the Connecticut program as well as in the University herds. Time does not permit a detailed report on every product tested. We shall describe merely the testing method most frequently employed at our station giving an example and comment on various products and practices. The procedure used is shown by a recent experiment.

To determine the value of tetracycline mastitis ointment containing 426 mg. per tube, the product was compared in a controlled experiment against a standard known effective penicillin-streptomycin combination ointment* containing 300,000 units and 225 mg. of the antibiotics, respectively, per tube. These two products were compared in 11 herds, six of which were under test for the first time under the Connecticut program. Quarters were considered infected when the secretion was found to contain a known pathogen associated with a high leukocyte count. Quarters were divided at random and the two treatments were administered by the senior author or a cooperating practitioner. Quarters considered recovered failed to yield the pathogen and revealed a marked reduction in leukocyte count when retested ten to 28 days after treatment.

In cases of *Streptococcus agalactiae,* tetracycline produced recovery in 83.8% of 167 quarters while the "pen-strep" compound produced recovery in 80.2% of 116 quarters. Against hemolytic micrococci, the results were 55.2% of 58 quarters as compared to 63.6% of 44 quarters, and against streptococci other than *Str. agalactiae* 66.7% of 51 quarters as compared to 87.5% of 40 quarters. On the surface tetracycline appeared to be a superior treatment for agalactiosis and inferior for the others. Statistical analysis of the data using chi-square revealed no significant difference between the two compounds against *Str. agalactiae,* all streptococci, hemolytic micrococci or all organisms combined. A low degree of statistical significance was detected in favor of the "pen-strep" compound for the treatment of streptococci other than *Str. agalactiae.* Essentially there was little difference between the two products. In herds where one product produced only fair results, it was not uncommon for the other to excel. Probably both should be retained on the practitioner's drug shelf for interchangeable use.

A trend in the manufacture of new udder treatments appears to be the production of sales "gimmicks" rather than products of proved, increased, therapeutic value. Adequate doses of penicillin (100,000 to 200,000 units), chlortetracycline (200 to 400 mg.) and tetracycline (400 mg.) are each known to be effective in the treatment of streptococcic infections. Further, each of these three products has been used successfully in programs to eradicate agalactiosis.

The major quarter treatment problem remaining is micrococcic infections and it is essentially at these that most combinations are directed. So as not to condemn all combinations, it should be stated that a combination of penicillin and streptomycin is probably as effective a quarter treatment as is presently available.

Little improvement has been observed in udder treatments where a single dose of penicillin in excess of 200,000 to 300,000 units was employed. In contrast it would appear to be necessary to increase the individual dose of streptomycin to 500 mg. in order to approach maximum efficacy, particularly in the treatment of micrococcic infections. Products containing bacitracin or neomycin in combinations were no more effective than their penicillin or combined penicillin-streptomycin content would

*Supplied by David Yellen Co., Canton, Mass.

have made them. When using oil or emulsion bases, there is apparently no added value from a single dose of more than 10 cc. However, when using water or other vehicles, from which antibiotics are quickly dispersed, large volumes and repeated treatments have given better results.

Reproductive Disorders

Artificial insemination has brought the problem of reproductive efficiency to the fore. Many herds now employ practitioners to conduct routine monthly pregnancy and reproductive physical examinations. Routine examinations frequently detect abnormalities before they have become so far advanced that it is difficult to treat them effectively. Besides the University herds, two vibriosis-infected herds and two vibriosis-negative herds are supervised from the standpoint of reproductive efficiency as a part of our experiment station research project on vibriosis.

Anestrus. A diagnosis of anestrus was made when one of the following conditions prevailed: (1) Estrus not detected by 60 to 90 days postpartum, (2) estrus observed at least once but no return detected by 45 days or longer, or (3) negative pregnancy examination without observed estrus since last date of breeding. It is admittted that, at times, anestrus is diagnosed in a normal cow in which estrus has occurred, but has been missed. If the condition of the ovary (when palpated) suggested this, animals were held without treatment permitting the necessary time lapse to observe estrus or confirm the anestrus diagnosis.

The hormone, estradiol cyclopentylproprionate (ECP)[®5], was used in 166 cases where accurate records were kept and over 100 cases wherein the information available was meager. Intramuscular injection of estradiol cyclopentylproprionate is, without a doubt, the most effective means available for inducing estrus in the anestrus cow. Recorded efficiency was about 90%. A 4 mg. dose was used most frequently and, at that dosage, less than one in ten animals exhibited extended symptoms of estrus following treatment and only two became cystic. Whenever palpation revealed a small or no corpus luteum, a 3 mg. dose ECP was employed successfully. Poor success has resulted from attempts to abort mummified fetuses with this product in our hands. In another interesting situation three cases which were misdiagnosed open, on early pregnancy examination, did not abort from use of the drug in an attempt to induce heat. (Possibly in the light of present findings in human medicine, this hormone could be applied in the development of an early pregnancy diagnosis for cattle.)

Cystic Ovarian Follicles. In three of our herds, 65 cases of cystic ovarian follicles have been treated. In the other two herds only one case has occurred in each. When detected early, manual rupture of the cyst alone has accounted for recovery of 50% of the cases. Follutein,[®6] a chorionic gonadotrophin, originating from the urine of pregnant women has long been our choice among therapeutic agents available with a recovery efficiency of 80%. Unfortunately, year by year, the number of nonresponding cases has increased. The hormone usually is given at the rate of 10,000 units intramuscularly. Failure to respond to this treatment was followed by the use of an additional 10,00 units given over a period of three days in divided doses. Only during the last two years has a second treatment failed occasionally. Of six cases that failed to respond after two treatments, two were sent to slaughter before additional therapy could be tried. Three of the other four became pregnant and carried normal calves, following the administration of a third treatment with follutein plus a dose of 500 to 1,000 units of leuteotrophin,[®6] a leuteotrophic hormone.

Treatment of follicular cysts, particularly slow responding cases, is a costly proposition. Furthermore there is a definite tendency to consider this a genetic problem. If this is the case, we wonder how good a cystic cow must be before we are doing the dairy industry a favor by helping her to produce another calf.

Retained Placenta. Once the cause of serious delays in reproductive efficiency, retained placenta need no longer be a serious problem. The writers have reported 32 cases of retained placenta (*Jour. Am. Vet. Med. Assn.*, 126:21, 1955) which under their management had subsequent records of breeding efficiency equal or superior to the normal calving animals in the same herd. Treatment consisted of the intrauterine administration of 500 mg. chlortetracycline oblets[®5] every other day until natural sloughing of the membranes occurred. No attempt was made to remove placenta manually. Five cases were treated using 500 mg. tetracycline oblets[®5] with the same degree of success. It seems likely that the time interval of dosage could be increased, particularly if a larger dose was employed. One gram

(Continued on page 122)

[®5]The Upjohn Co., Kalamazoo, Mich.
[®6]E. R. Squibb & Sons, New York, N. Y.

Some Advantages To Be Expected From Organized Animal Disease Reporting Programs

L. OTIS EMIK,* Ph.D., Atlanta, Georgia

IT must be stressed, as the basic concept underlying this whole discussion, that the benefits which can be expected from animal disease reporting programs are completely derivative. The collection of data can be of benefit only through its proper use and application to provide intelligent methods of disease prevention and control. This statement is intended to enumerate general methods through which animal disease reports may be expected to provide specific fields of benefits. The general principles must be applied on a broad, cooperative basis in order to accomplish these benefits.

Collection of periodic reports on the incidence and prevalence of animal morbidity or the incidence of mortality is the first step toward animal disease intelligence. Animal disease intelligence, in this regard, denotes the provision of information concerning quantitative time and space distribution of a disease necessary to provide a base for planning its prevention and control. Animal disease intelligence is the first step in an animal health program. The problems must be defined, then the health program must provide the necessary implementation to accomplish disease prevention and control. Thus, the benefits which may accrue from reporting are derived invariably by some kind of action based upon submitted reports.

There are in existence a number of kinds of reports of animal diseases. One kind is the mortality report. The second and third types are two variants of morbidity reports. Diseases which may become epizootic in proportion usually are reported directly to the livestock regulatory officials by telephone. Chronic enzootic diseases are reported periodically on a written report, if at all. Postmortem evidence of pathological conditions may be reported as a fourth type of evidence of the existence of disease. The necessity for laboratory confirmation of certain diseases has resulted in a fifth type of reporting, the laboratory-confirmed case.

Assuming that a complete system of reporting has been developed, just what benefits may be derived, and who will derive them? Which benefits exist, and how may others be developed? Has anyone done these things already?

The possible benefits from reporting are more or less classified by types of disease. Those diseases which may spread easily and rapidly, to cause severe losses, often are called epizootic diseases. A report of such a disease should be made by telephone, and the proper authorities should act immediately to prevent its spread. Diseases such as foot-and-mouth disease, vesicular exanthema, fowl plague, glanders, and rinderpest fall into this category. Diagnosis should be verified and appropriate preventive action taken. Slaughter of infected and exposed animals, disinfection of premises, vaccination, quarantine, and elimination of the transmitting mechanism may be used for control or eradication.

Enzootic diseases occur continuously in varying intensities in given areas. They may flare into epizootics with the proper conditions. An important function of a reporting system is to provide reliable information concerning the geographic and time distributions of such diseases. This information would furnish descriptions from which the future normal status of a disease might be predicted. Methods for combatting the enzootic state may be improved or devised from these patterns. Deviations from the expected pattern would forecast trouble before it is too late, and should trigger the appropriate control measures. This phase of action is in its infancy in the animal field. Most diseases fall into this category; *e.g.* salmonellosis, brucellosis, tuberculosis, and Newcastle disease.

A third main group is those diseases for which the existent information is incomplete. Etiology may be in doubt, methods of transmission may be undetermined, therapy and

*Communicable Disease Center, Public Health Service, U. S. Department of Health, Education, and Welfare.

control measures may be unknown or the diagnostic technics may be undeveloped. Reports of this category of diseases, *e.g.* mucosal disease, hyperkeratosis and chronic respiratory disease, may provide information from which field investigation and research can be developed to provide answers to questions.

Actually, many classes of people may be expected to benefit from a complete animal health program. First and foremost is the livestock producer. Adequate information will tell him better how to maintain sanitary premises and healthy stock through his own activity, as well as through improved service from his veterinarian and local and state animal and public health officials.

The practicing veterinarian will benefit from cooperation in the program in a number of ways. He will receive reports of the occurrence of disease in the area of his practice and of the existence of disease in other areas which might spread into this territory. Combined with other information, a more reliable basis will be provided for sound immunization programs and other measures needed to prevent the introduction of disease into an area, or to prevent or control diseases enzootic in the area.

Livestock sanitary officials could provide more adequate regulations and information enabling the producers to be reasonably certain that imported stock would not bring disease into their herds.

Local and state health officials will receive a distinct benefit from animal disease reports. Usually the zoonoses will be reported initially in the animal population of a given area. Such reports will alert those officials to the possibility of future human cases. Measures can be taken in the area of responsibility of human health agencies to prevent transmission of these diseases, and to cooperate with animal health agencies in eliminating the hazard, particularly where their administrative spheres overlap. New zoonoses might be discovered by correlating human and animal disease reports.

Veterinary research facilities would be provided with information concerning the occurrence of diseases which are known to need investigation, or which, on the basis of reporting, assume potential significance and require investigation. Information will be available to define problem areas suitable for field investigation in epizootiology, or to locate suitable research materials. Also, material will be provided for statistical research in epizootiology, a valuable adjunct to the full concepts of the dynamics of disease prevention and control.

A reporting system will provide necessary data to the medical and veterinary officials concerned with preventive medicine for evaluation of the efficacy of preventive and control procedures, either for standard or for experimental situations. Already, animal morbidity data have assisted the officials of one animal health program to determine the most effective utilization of tax funds. The continued economic support of a program is usually dependent upon evidence of its success. This evidence will be important to the producer also, since his own herds may have escaped a given disease and a concept of the benefits to himself or his neighbors may only be apparent through a comparative analysis of data from areas with and without the particular protection afforded his animals.

Groups allied with production and marketing of animals and animal products, including processors, feed manufacturers, and biologics manufacturers, would benefit from the program. The packing and processing industry, as well as transporters, would have employees subjected to less risk of exposure. Carcasses would be of better quality and provide more valuable retail products. The benefits to biologics manufacturers are readily apparent as nearly all therapy and immunization is dependent upon their products. If biologics manufacturers are integrated properly into the animal health program, their services will improve in two ways. First, appropriate quantities of the right product will be more readily available at the correct time and place, based upon a knowledge of the estimated distribution of various diseases. Second, new products will be developed as reporting defines the disease problems. This development will include research on etiology, vaccines, and therapy.

Ultimately the consumer of meat or animal products will benefit through the availability of more nutritious and disease-free meat, milk, eggs, and other products.

Disease eradication and control could provide inestimable improvements in production. For instance, in the United States the life span of man has increased nearly 30 years during the last 50 years. A major portion of this change has occurred through a reduction in deaths under five years of age. A similar saving of young animals would provide a tremendous boost to production. Control of the human adult cripplers like typhoid and tuberculosis has lengthened the useful life

span of many thousands of people. A longer productive life, a longer generation interval of breeding stock, and improved over-all quality of all animals would increase the number of gestations per animal, permit better selection, and increase the marketing of better quality animals.

Many benefits will be realized only after years of persistent effort. It has taken close to 40 years to arrive at the point where it is believed that poliomyelitis soon will be conquered. Control activities have succeeded in reducing the incidence of brucellosis in animals and some channels of transmission to man, but the disease still occurs in every state, and remains a threat to man and animal alike. The resurgence of brucellosis during World War II is a concrete example of what can happen when vigilance is relaxed. New technics and renewed efforts again give hope that brucellosis is now on the road to eradication.

Some of these expected advantages are existent, and have been for years. Epizootic disease outbreaks such as foot-and-mouth disease, Texas fever, anthrax, and vesicular exanthema have been controlled. Enzootic diseases such as tuberculosis and brucellosis have been suppressed. Others such as hyperkeratosis, atrophic rhinitis, mucosal disease, leptospirosis, and avian infectious bronchitis are being studied. Material benefits have been provided, but largely on a specific disease basis. The time is now appropriate to follow the example of public health and expand these activities into a general program which will provide prolonged life, increased efficiency and greater production for all animals, through the organized effort of the country as a whole in the application of broad epizootiological principles. Defensive and offensive weapons are available to establish an animal health program which even can surpass our public health program. The human must be preserved, and can not be used as an experimental animal. These restrictions hamper research and disease eradication in public health. There are only two limiting factors to the potential accomplishments in the animal health field. First is the willingness of all to cooperate. Second is the passage of time.

Figures and investigations are lamentably absent which could be used to place these values in dollars and cents or increased human health. Publicity to the producer must include some estimates when the meager information now available is scrutinized. An important function of an animal health program will be to collect better figures and pass them on to the producer, veterinarian and others.

A full statement of benefits also will include an examination of the dangers which must be subtracted to obtain the net effect. One commonly reiterated philosophy is that the big producers, especially in the West, will not support such a program since the spread of animal disease intelligence may result in the embargo of their stock by an importing state. Although this philosophy may be prevalent, it is born of immediate economics and without consideration of long-term gains. Consider the swine disease which recently caused so much trouble — vesicular exanthema. There was adequate knowledge of its enzootic existence, its methods of transmission, and control. There was not adequately distributed knowledge of the potential damage which it could cause. The swine industry, government, and others lost millions of dollars when vesicular exanthema finally broke loose and spread throughout the United States. The circumstances may not be so spectacular, but many other communicable diseases are spread back and forth across the country every day, both wittingly and unwittingly. Some of these are animal health problems with restricted foci and should be held within such foci pending eradication. Other diseases are so ubiquitous, or control methods may be so effective, if utilized, that they constitute only a local or individual problem. A responsible national authority will have the task of defining the problems, methods of attack, and of educating all concerned parties in the judiciousness of their decisions.

The necessary education of the public in animal health methods will require many and repeated doses of knowledge, with time for each dose to be properly assimilated. Much of the necessary knowledge for animal health programs can be gained only through experience. To implement the acquisition of this knowledge, the U. S. Public Health Service is sponsoring pilot studies in animal morbidity reporting in cooperation with a number of states. These studies are designed to investigate and develop efficient procedures of reporting, and to initiate and increase service rendered on all fronts. As a prerequisite, the state health agency and livestock regulatory agency operate jointly and cooperatively, just as the role of the Public Health Service has been developed with the advice and cooperation of the U. S. Department of Agriculture.

Ohio provides an outstanding example of a cooperative program at work. This program

is jointly sponsored by the Division of Animal Industry of the Ohio Department of Agriculture, the Ohio Department of Health, Ohio Office of the Animal Disease Eradication Branch of the U. S. Department of Agriculture, and the U. S. Public Health Service, with the endorsement of the Ohio Veterinary Medical Association. The reporting system began in January, 1953. A monthly bulletin to the practitioner was started immediately which incorporated monthly statistics, news items on disease control, and featured timely articles on diagnosis, treatment, and prevention of diseases. District veterinarians of the Ohio Department of Agriculture and U. S. Department of Agriculture began to investigate reports of unusual incidence of disease. Every report of vesicular disease was checked and the diagnosis confirmed. The Department of Health and the Division of Animal Industry took an immediate interest in leptospirosis. A leptospirosis survey was undertaken by the Division of Animal Industry with the cooperation of the Bacteriology Department in the Veterinary School at Ohio State University. Laboratory diagnostic services of the Division of Animal Industry and the Department of Health are available at the request of the veterinary practitioner. The Division of Animal Industry, in cooperation with the poultry industry, successfully carried out an experimental plan for immunizing young birds against avian infectious bronchitis. Training films and other educational services are provided for veterinary meetings. One veterinarian has used the monthly bulletin as the basis for a monthly talk on television. A multitude of other special and routine activities cement this program into a truly fine example of what can be done with an animal health program in less than two years.

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Therapeutic Notes from Cattle Practice

(Continued from page 118)

doses of streptomycin in bougie form have produced comparable results in seven cases.

Repeat Breeding. The problem of repeat breeding is, in all probability, the biggest bug-a-boo in the overall problem of sterility in cattle. This subject has been discussed in a companion paper (see VETERINARY MEDICINE 50:51 [Feb.], 1955).

Incidence Trends of Communicable Diseases

The number of cases of human psittacosis reported in 1954 approximates the total of those reported for the preceding seven years. A large number of these occurred among personnel in poultry dressing establishments.

No positive cases of smallpox were reported in the United States during the calendar year past, marking the first time since this disease was made notifiable that the incidence was nil for a 12-month period.

Incidence of human infectious hepatitis continued to increase and was 50% greater than the preceding year; malaria cases total about one-half those reported for 1953, and encephalitis and poliomyelitis increased over 1953 but was below the number reported for 1952, an epidemic year.—*Morb. and Mort. Wkly. Rept., Pub. Hlth. Serv., Jan. 7, 1955.*

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Solar Heat for Poultry Houses

Pennsylvania poultrymen, in cooperation with the Agricultural Experiment Station, are experimenting with solar heat and insulation as a means of keeping litter dry. Thermopane fronts for laying houses with overhanging, adjustable sunshades and intake and exhaust openings above the windows are used with insulated walls to accomplish the purpose.

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Resistances to Coccidiosis

According to Champion (*Poultry Sci.*, 33:680, 1954), selective breeding was effective in establishing lines of chickens resistant and susceptible to cecal coccidiosis (*Eimeria tenalla* infection). These findings are of great academic interest but probably will have little influence on the future prevention and control of this acute disease.

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Young turkeys are more resistant to muscular fatigue than are young chickens, according to research work done by Garren and Shaffner (*Poultry Sci.*, 33:866, 1954) at the University of Maryland.

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The nation's manufactured feed industry now is supplying 30% of all feed consumed by livestock and poultry, exclusive of roughage and pasture—*Feeding Forum.*

Infertility In Cattle: Some Observations

E. A. WOELFFER, D.V.M., Oconomowoc, Wisconsin

ONE of the important "leaks" in efficient milk and meat production is the problem of infertility in both beef and dairy herds. Interest in the problem by livestock owners has been stimulated in recent years by advancements in artificial insemination, research in breeding, and a desire to lower production costs. It is important that veterinary practitioners recognize the present situation as one in early stages of transition and that the future offers a challenge and an opportunity. The lessons learned from additional research must be applied if greater proficiency in practical service is to be achieved.

A Herd Problem

For the most part, reproductive failures must be considered as herd problems, much the same as mastitis control is recognized to be a unit program. A planned breeding program is essential if reproductive efficiency is to be maintained satisfactorily year after year. The practitioner is in position to offer valuable service by establishing a practical program or he can give council and advice on matters that pertain to better breeding practices. For example, clients must be impressed with the fact that some females are difficult to observe in heat, that cows should not be serviced too soon after calving, that good heat and service records are necessary, and that periodic veterinary examination of the herd are good management practices.

A Herd Survey

Consider you have been asked to make a survey of a herd to diagnose its breeding status. You will find it helpful to make a rapid but thorough survey of the herd either beforehand or at the time of your first visit. Often this can be done while slipping on your coveralls and obstetrical sleeve. Depending upon circumstances, the survey may include a check on feeding and management practices for both young and mature stock, on the condition of the herd, on sanitary practices, et cetera. What is the brucellosis status? Have there been abortions or irregular heat periods? How are heat periods observed? Are females bred naturally or are they artificially inseminated? How are the bulls handled and kept? How often are they used? What is their condition? Are they physically sound? Were they purchased, and at what age? Does the herdsman keep heat and service records? If so, what do they reveal? Much of this information and more can be obtained in a preliminary survey or while in the process of examining the herd.

The information gained at this time is often extremely important. It helps in establishing a diagnosis. It may indicate infectious disease, such as trichomoniasis, vibriosis, or leptospirosis, or it may reveal poor observation of heat periods, too early breeding after calving, or too heavy use of the herd sires.

What to Examine

In our practice, we record the findings and the treatments administered to each individual on a sheet upon which is noted the date of examination and the owner's name and address. The original sheet is left with the owner and a carbon copy is retained for our files. Herd surveys or examinations generally are made at intervals of two weeks to 30 to 90 days, depending upon circumstances. Most of the larger herds are visited approximately once a month. We usually examine the following individuals on our regular visits:

1. Females bred 30 - 33 days or more to determine pregnancy.

2. Females that have freshened 30 days or more to determine the condition of the reproductive tract. This applies principally to females that have discharged normally their fetal membranes and do not show abnormal discharge from the genital tract.

3. Animals that recently have freshened and have retained their fetal membranes or show abnormal discharges are examined and treated anytime after freshening. The sooner this is done, the better.

4. Females with abnormal estrual periods, abnormal discharges, or any other irregularities.

5. Animals in heat are also often examined, especially those females that have been serviced three or more times.

6. If brucellosis, vibriosis, trichomoniasis, or leptospirosis is suspected, the necessary tests are made or recommended. For example, if trichomonad infection is suspected, sheath swabs of the herd sires are taken with plastic pipettes (Bartlett) or preferably with the douche method (Binn). In addition, vaginal swabs of virgin heifers are obtained 14-19 days following service. If *Vibrio fetus* is suspected, a diagnosis is attempted submitting aborted fetuses to a laboratory, artificial inseminations are resorted to and the semen dilutor is treated with antibiotics. When deemed advisable, uterine infusions containing streptomycin are employed before or after service.

Examining the Individual

At the time of rectal palpation, a glance observation of the cow, particularly of her pelvic region, is advisable. Relaxed ligaments in combination with a swollen or thickened vulva in the nonpregnant cow is largely a manifestation of a cystic condition. A gaping vulva, usually from injury and particularly one in which the dorsal commissure tips anteriorly, usually permits feces and infection to enter the vagina. This invariably produces an irritation and a ballooning of the organ. Individuals so affected do not conceive readily. Vaginal irrigations with mild antiseptics or antibiotics are often helpful but superior results usually are obtained when, in addition to the irrigations, the upper portion or half of the vulva is sutured. We use nylon suture and employ the technic described by Roberts[1].

When examing females, make it a cardinal rule always to check for pregnancy first. Mistakes in record keeping occur in the best of regulated herds. A herdsman may insist that a certain cow has not been bred and does not come in heat. It is not uncommon to find such cow safely in calf. The missing service date usually turns up after a more careful search of the records.

Some Common Findings

Many abnormal and normal variations are found when examining cows. In this paper we can mention only a few of the more common conditions found. Recognition through palpation of the normal organs and related structures is necessary before the operator is in position to distinguish between the so-called normal and the abnormal or diseased tissue with a relatively high degree of accuracy. Without a good history it may be difficult to diagnose by palpation whether embryonic death or early abortion has occurred, or whether a low-grade metritis is present.

If "no heats" is the report, and a corpus luteum of normal consistency and size is palpable in one of the ovaries, be suspicious that the heat period was missed. In such cases, tactfully point out the importance of close observation and the possible occurrence of short or so-called "silent" heat cycles. To artificially disrupt the heat cycle, we employ dislodgment of the corpus luteum or give injections of stilbestrol or estradiol cyclopentylpropionate (ECP)®[1]. Our results with estrogens are comparable to those reported by Easterbrooks and Plastridge[2] of Connecticut and Lindley[3] of California.

Hard or indurated ovaries that contain small or partially developed follicles usually are found in cows that fail to show estrum. The condition is an indication of static or subnormal ovarian activity. Such cases usually respond more favorably to follicle-stimulating hormones than to estrogens. In cases of cystic degeneration, we crush the thin-walled cysts and inject 10 units of sheep pituitary hormone, 25 to 50 units of anterior pituitary gonadatrophin hormone, or 5,000 units of chorionic gonadatrophin in the vein, or 10,000 units intramuscularly. When using the intravenous method, one must be aware of the possibility of an occasional allergic reaction.

Pyometra

Pyometra cases are not uncommon and care must be exercised that the diagnosis is not mistaken for pregnancy. Usually, in these cases, the cervix is not well sealed, membranes in the horns can not be palpated, and the corpus luteum is generally smaller, more firm, and often deeply imbedded. If there is a considerable amount of pus present, we like to administer a maximum recommended dose of estrogen, followed in 24 hours by posterior pituitrin or purified oxytocic principal (POP)®[4]. On the next visit, we usually infuse the uterus with a suitable uterine antiseptic or antibiotic. A favorite product for infusion is an aqueous solution of tyrothricin made by mixing 20 cc. soluthricin®[5] with 1,480 cc. of water, preferably distilled water. The usual dose is 250 cc. by means of a gravity-flow intravenous outfit. We also employ sulvetil®[6]

®[1]The Upjohn Company, Kalamazoo, Mich.
®[2]Armour Veterinary Laboratories, Kankakee, Ill.
®[3]Sharp & Dohme, Inc., Philadelphia, Pa.
®[4]Abbott Laboratories, North Chicago, Ill.

(Continued on page 141)

The Clinical Laboratory In Small Animal Practice†

ROBERT B. McCLELLAND, D.V.M., Buffalo, N. Y.

EACH of us can serve his fellow man best by being a good veterinarian. The practitioner's task, the unending search for truth, is never more important than in the field of diagnosis. A clinical laboratory of his own, even a very simple one, is an excellent aid; an aid, but not an end in itself, for the main factors in diagnosis must still be case history and physical diagnosis. A Scottish physician, McKenzie, wrote, "No machine or laboratory test can ever replace the doctor in evaluating a patient and his illness. These are tools and aids, but they have to be ordered and interpreted on the basis of a physician's knowledge, experience, and insight."

Most practitioners use their knowledge of clinical pathology to good advantage, especially in urinalysis, blood chemistry, and blood cell counts. The majority send their samples to private or public laboratories. Results are good. However, the veterinarian with a laboratory of his own claims several distinct advantages. He offers quicker and more efficient service; he has personal control of the various tests required and results are uniform.

The owner of an animal never thanks the veterinarian directly for establishing a laboratory in his hospital. The client is interested in only one thing, a diagnosis. From that premise, he wants two simple deductions; will the animal live, and how much will it cost to "cure" him. If the prognosis is poor, or if the cost of treatment is beyond his financial reach, the doctor is likely to lose the patient before therapy is initiated. It is discouraging to note that those who don't try to make a correct diagnosis pay just as much income tax as those who seek the truth.

The Basic Laboratory

The clinical laboratory is built around the microscope. Even if it is an ancient, second-hand monocular, it is the most valuable asset in the clinical diagnostic laboratory.

For urinalysis, the most important instrument is the urinometer. Some like the Adam's miniature urinometer because it requires less than 10 cc. of urine to support the float. The Ames Company of Elkhart, Indiana, makes a compact plastic tray containing reagents, test tubes, and droppers. It allows quick, simple tests for albumin, acetone, and occult blood. Samples of urine obtained by catheterization are preferred. The catheter should be clean, and should be inserted with caution. A diseased bladder is ruptured easily.

With the above meager equipment, urinalysis is made easy. In less than ten minutes, the clinician can either clinch diagnosis, or screen those cases that need additional blood study.

Most owners are pleased when the veterinarian performs these simple tests in their presence. When they are shown the four-plus albuminuria of prostatitis, they are anxious for treatment. They are happy when subsequent samples show a reduction in albumin reaction. A demonstration of low, fixed, specific gravity helps the client to understand some of the complexity of chronic interstitial nephritis.

The hemotocrit tube is a useful investment.

†Presented at the 21th annual meeting, American Animal Hospital Association, New York City, May 5-9, 1954.

When employed in the sedimentation test, it is helpful in both diagnosis and prognosis. In determining the packed cell volume, it adds to the clinicians evaluation of the disease picture.

The hemoglobinometer and hemocytometer are basic equipment for blood studies.

Dr. Charles Bild of Miami believes the LaMotte blood urea test to be most satisfactory for the busy clinician. If a laboratory technician can be added to the hospital staff, efficient use of laboratory instruments available for various urine and blood studies is assured.

Suggested Items of Laboratory Equipment

For the Beginner.

Manual of Veterinary Clinical Pathology by David L. Coffin.
Microscope
Test tubes, slides, coverslips
Centrifuge
Urinometer
Urinalysis unit
Hemoglobinometer
Hemocytometer

For Added Information.

Hematocrit tubes
Wright and Giemsa strains
LaMotte blood urea and sugar units

For the Labhappy.

Government subsidy
Pretty technician
Shelves and shelves of reagents and glassware
Micrometer
35 mm. camera

A clinical laboratory will not add to a veterinarian's income, but it will increase his professional stature and serve to confirm clinical diagnosis.

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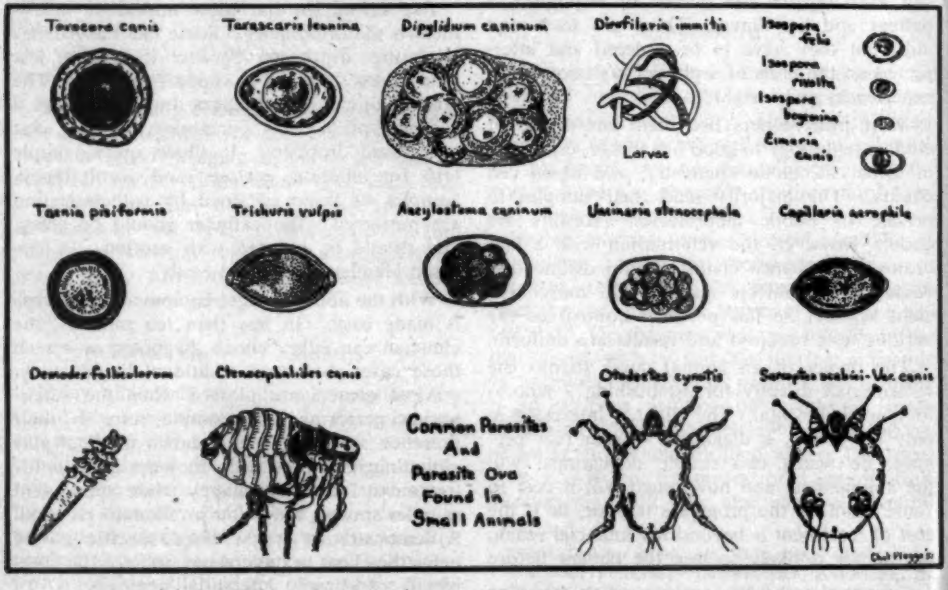
In an editorial appearing in the June 6, 1953 issue of the *Journal of the American Medical Association*, in regard to neoplasms in identical twins, it is tentatively concluded that there are at least three ways in which identical twins are more similar to each other than are nonidentical twins: (1) "The chance that both of a pair of twins will be affected by tumor if cancer develops in one is much greater for identical twins than for nonidentical twins." (2) "Should both of a pair of twins be affected, the chances that the tumor will be similar in both is much greater when the pair are identical." (3) "When both of a pair are affected, the age of the twins at the onset of the tumors is more clearly the same when the pairs are identical."



Charts prepared by Drs. Harry C. Eschenroeder and Chester R. Plegge

Reproduction of lithographed charts of parasitic ova and parasites common in dogs.

Interpretation Of White Cell Count, Sedimentation Rate And Packed Cell Volume†

ROBERT P. KNOWLES, D.V.M., Miami, Florida

FOR the purpose of this discussion, we are concerned primarily with the interpretation of three commonly used laboratory procedures. These are leukocyte determination, or white blood cell count, sedimentation rate, and packed cell volume.

These tests were chosen arbitrarily and the attention of the reader should be directed to the fact that they are not necessarily related. It is in this field of interpretation of clinical laboratory tests that the art of medicine is capable of its freest expression.

Investigation of a clinical disease entity through a correlation between physical examination of the patient and selective and judicial use of clinical laboratory procedures presents the ultimate in clinical medicine. It is perhaps misleading to attempt to consider specific tests individually, since in actuality laboratory procedures exhibit an interrelated reciprocity which renders them impossible to segregate. However, space available dictates that an attempt must be made to consider these three tests separately and not necessarily in relationship to other tests which would logically proceed or follow them in the thorough examination of a patient. Actually the history and physical examination of the patient should suggest certain laboratory procedures. The results of these, in turn, should either confirm suspected diagnosis or lead to further tests along various lines indicated by results. In clinical medicine, this is the case.

For purposes of this discussion we will not concern ourselves with the technics employed. This is largely a mechanical process and information required for methods are available in standard laboratory text books. The writer suggests to the interested reader the first four books listed under references.

Leukocyte Enumeration

Leukocytes, or white blood cells are the body's primary defense against disease. The response of the white blood cells to advent of a disease process is rapid and, generally speaking, in direct proportion to the severity of the attack.

Although there is some argument regarding the physiological limits of the white blood cells, it is agreed that the acceptance of normal values, which have an extremely wide variation, limit usefulness of this determination. If it is to have clinical significance, rather definite and narrow limits must be accepted. Exceptions occur in all cases and, from a clinical standpoint, it should be agreed readily that it is wiser to consider a narrow standard and to be willing to accept the occasional variation from that which occurs normally, than to consider any variation within the widely quoted normal limits as being normal. This being the case, the normal white cell count in the average dog is found to approach closely the variation between 10,500 and 12,500[5]. Variations from this figure upward usually indicate bacterial infection, the degree of increase generally parallels the severity of infection. In relatively mild infections, not involving active production of pus, such as would be found in a commonly called "strep throat," we would expect a white cell count evaluation up to 15,000 to 17,000. In abscess formations, such as is commonly encountered in cats, white cell count often will run upward to 20,000. Pus under pressure can elicit a rather severe leukocytosis with white counts up to 68,000. In infections involving larger areas but without obvious pus formation, such as pneumonia, a white cell count of 18,000 to 22,000 is common. In chronic infections such as pyometritis, the classical white cell count is 30,000 or above. In those cases in which a white cell count of 100,000 or more is found, a specific disease involving the reticulo-endothelial system such as leukemia is suspected.

The opposite is true generally in virus diseases; that is, there is a leukopenia, or decrease in the number of white cells in the peripheral circulation. Here again the degree of drop below normal generally will parallel severity

†Presented at the 21st annual meeting, American Animal Hospital Association, New York, N .Y., May 5-8, 1954.

of infection. In the event of mild tonsillar inflammation and other evidences of disease, with a bacterial infection, as stated above, we would anticipate a white cell count of 15,000 to 17,000 or 18,000; however, if a white cell count is determined in such a case and the results are 7,000 we would logically suspect hepatitis, although in the beginning stages the physical signs be indistinguishable. This diagnosis would then either be confirmed or denied by the logical succession of laboratory tests which should follow white cell count determination.

The two most common virus diseases occuring in dogs, of course, are distemper and hepatitis. Differentiation can not be accomplished by history, physical examination, and the determination of the three tests under discussion. History is quite important, particularly the history of previous immunization, method of immunization, or condition of the dog during the time it was immunized. In many cases our positive diagnosis must wait for some indication of the disease course and response to therapy. In both diseases, white cell counts down to 3,500 to 4,000 are not uncommon.

Perhaps the most striking example of specific virus diseases producing a leukopenia is in infectious enteritis or panleukopenia of cats. In this disease counts below 1,000 are recorded.

White cell counts repeated approximately every third day are most efficient for following the course of bacterial disease under therapy. During the throes of serious diseases the gyrations of the white blood cell level are sometimes stunning. Daily determinations are likely to confuse the issue rather than aid in the establishment of definite trends. Generally speaking, if a count is elevated at the onset of a disease, or on presentation of the patient to the veterinarian, a gradually decreasing count toward normal is indicative of progress. Quite often in severe illnesses it will be found that after the advent of therapy white cells will take a decided jump and then gradually fall to normal. Perhaps the introduction of our antibiotics disturb antagonistic balance between the body defenses and the antigenic agent causing the disease. This balance may be disturbed in the direction of the body, thus enabling the production of an excessive number of white cells rather rapidly. It is not uncommon in following the course of a disease, particularly one that is prolonged, to find a white cell count drop to normal and below before gradually rising to the normal level to be maintained thereafter. It is conceivable that this phenomenon is the result of body fatigue after the battle is over.

In most virus diseases that respond to therapy, concurrently with the obvious signs of the improvement, the white cell count is elevated, sometimes up to as much as 18,000. From this point it usually will subside to normal gradually. It is felt that in this particular case, white cell production facilities again are released by the institution of therapy, thereby permitting the body to produce a large number rather rapidly. A gradually decreasing white cell count in virus diseases is a grave sign as is a gradually increasing white cell count in bacterial diseases. Occasionally, in dealing with a bacterial disease in which an elevated white cell count occurs, it is found that they will reach their peak in concentration and then drop part way to normal but level off at a level ordinarily considered to be indicative of pathology. Usually this level is maintained only for a temporary period. Sometimes up to two or three weeks and rarely it is maintained on a more or less permanent basis. In most of these cases in which it does remain permanently elevated, the enduring pathology is evident at autopsy.

Sedimentation Rate

The sedimentation rate of erythrocytes is a nonspecific reaction, the causes of which are not understood thoroughly. Suffice it to say that the rate of settling or sedimentation of erythrocytes under standard conditions is increased in the presence of certain disease states. This being the case, the determination of rate then is of diagnostic as well as prognostic value. The sedimentation rate determination should be regarded as a somewhat different and sometimes more sensitive criterion of body reaction to injury than are fever and leukocytosis; hence its chief value is not in differential diagnosis but in following the progress of the individual case. A normal rate does not exclude disease, but a rapid rate is a valuable and easily secured indication for further study. It is, however, a nonspecific reaction so that the information given is of a general character, as a measure of the presence and intensity of morbid processes. One of its more important clinical purposes is in the detection of more or less occult conditions.

In general terms, an accelerated rate always suggests organic disease rather than a functional disorder, inflammation rather than a tumor, and malignancy rather than a benign tumor. It is of particular value as a guide to

the progress and activity of an infection. It also possesses prognostic value as a progressive decrease to normal is indicative of favorable progress, while a persistently increased rate indicates the reverse.

Although the mechanics of increased sedimentation is not thoroughly understood significant increases in rates are due almost entirely to clumping of red cells into larger aggregates than usual. In some cases this is caused by alterations in the surface protein content of the cells.

There are various methods of determining this test, and although the results of each are not quantitatively transferrable from one method to another, the degree of increase in rate will be roughly proportional by the use of different methods. The accepted normal rates as determined by the Wintrobe and Cutler Methods are as follows:

Wintrobe Method. 0-15 mm. — 1 hour is normal; 16-20 mm. — indicative of a limited or minor disease process; 21-30 or above 30 mm. — grave situation.

Cutler Method. 0-8 mm. — per hour normal; 8-15 mm. — moderate; 12-20 mm. — severe; above 20 mm. — serious.

Although the interpretation of the sedimentation rate is considered primarily in the light of prognosis rather than diagnosis, Monlux states that the sedimentation rate always is elevated in leptospirosis. He is of the opinion that in cases in which leptospirosis is suspected, if an elevated sedimentation rate is not present, leptospirosis can be eliminated.

A final note of precaution is necessary. It must be recognized that the sedimentation test is subject to many errors and, is a crude approximation. Balanced clinical judgment is necessary in its interpretation. When this attribute is applied to the values obtained in the laboratory, the test may be extremely useful. When this attribute is lacking, the test is more often misleading than helpful[8].

Packed Cell Volume

The packed cell volume and the indices which are obtainable from its determination, is the most accurate method of detecting the presence of and of differentiating between the various types of anemia. The volume of packed erythrocytes affords the same kind of clinical information as total erythrocyte counts and the hemoglobin estimations. According to Wintrobe, it is the most useful single criterion of the degree of anemia or polycythemia now available[8].

Although anemia is encountered more commonly, hemoconcentration is a nonetheless serious situation. The employment of the Wintrobe tube is one of the most sensitive tests in detecting hemoconcentration and in rating the degree of severity.

Anemia is unquestionably one of the major blood dyscrasias observed in clinical veterinary practice. Kracke[7] has suggested that all anemias should be classified into one of four large groups as follows:

1. Iron deficiency anemias
2. Deficiency of antianemic factor
3. Hemolytic anemias
4. Anemias of bone marrow damage

He states that, "In nearly every instance any anemia can be classified into one of these four groups by carrying out a certain group of laboratory procedures which should include the following: Red cell count, white cell count, hemoglobin estimation, differential cell count, reticulocyte estimation, packed cell volume, computation of volume index, computation of color index and fragility tests in the hemolytic type". The studies outlined above will enable one to classify anemia into a hematologic classification which is based on the number of red cells, hemoglobin content of cells, and size of cells.

The packed cell volume determination is considered by leading hematologists to be a more sensitive indicator of variations in the size of red cells than is determination of the erythrocyte diameter alone. It might be well to call the attention of the reader to the fact that, in addition to estimation of the packed cell volume, the mean corpuscular volume, the mean corpuscular hemoglobin and the mean corpuscular hemoglobin concentration, by using the Wintrobe tube and method, it also is possible to determine a rough estimate of the white cell count and to achieve a gross estimation of the icterus index.

The packed cell volume (PCV) is actually the percentage volume of red cells per unit volume of blood and is recorded by reading the height of the packed cell mass in millimeters. Normal is 50-55 mm.

The mean corpuscular volume (MCV) expresses the mean volume of the red cells in cubic microns. The normal MCV is 64-72 cubic microns.

The mean corpuscular hemoglobin (MCH) expresses the mean relationship between hemoglobin and red cells and is expressed in micro micrograms. The normal is 19-23 micro micrograms.

The mean corpuscular hemoglobin concentration (MCHC) expresses the concentration of hemoglobin in the mean corpuscle and is expressed in percent. Normal is 29.4 to 32.6%.

Through the use of these indices it is possible to classify anemia according to three variables as suggested by Kracke,[7] Kolmer[8] and others. The first is red cell numbers which are classified as follows: If the number of red cells is normal the anemia is said to be normocythemic; if the number of red cells is reduced, the anemia is referred to as hypocythemic, and in those rare instances when the number of cells is increased above normal, the anemia is referred to as hypercythemic.

Secondly, we are concerned with the hemoglobin content of the cells. If the hemoglobin content is normal, it is referred to as normochromic, if reduced, it is referred to as hypochromic; and if increased, it is referred to as hyperchromic.

Thirdly, we are concerned with the size of the cell; if the average cell is normal in size, it is referred to as normocytic; if it is smaller than normal, it is referred to as microcytic; and if it is larger than normal, it is referred to as macrocytic. Some anemias, therefore, are hypochromic and microcytic, others hyperchromic and macrocytic, et cetera. According to the classifications suggested by Kracke[7] the four types of anemia then would be classified as follows: Typical iron deficiency anemia is hypocythemic, hypochromic, and microcytic. Anemia due to deficiency of the antianemic factor is hypocythemic, hyperchromic, and macrocytic. In the various types of hemolytic anemia the classification will vary. The typical type is hypercythemic, hypochromic, and microcytic but there are certain types of anemia which fall under this classification which are hypocythemic, hyperchromic, and macrocytic. In anemia of bone marrow damage, the classification is hypocythemic and this is always severe, but it is normochromic and normocytic. The iron deficiency anemias may develop because of hemorrhage, various nutritional deficiencies, chronic diarrhea and ulcerative colitis and intestinal parasitism of all types. It may result from infectious diseases, particularly if prolonged, inadequate diet, far advanced malignant tumors, and other conditions. Iron deficiency anemias, according to Kracke, comprise well over 90% of all anemic states.

The anemias due to the deficiency of antianemia factor or the commonly called macrocytic anemias can occur in far advanced liver disease, certain forms of tropical anemia, faulty absorption from the intestinal tract and stomach, et cetera. The hemolytic anemias are caused by excessive intravascular destruction of red cells. These include acute hemolytic anemias, anemia of sulfonamide drug administration, anemia of lead poisoning, hemolytic anemias of the new born (snake venom produces this type of anemia. Arsenical compounds are capable of causing it which also occur associated with certain types of splenomegaly). In the anemias of marrow damage, the classical picture is usually one of reduction of all cellular elements produced in the marrow. Under this classification come the aplastic anemias. This type can be caused by continued exposure to certain chemical agents such as benzene. In rare cases, arsenical preparations are capable of producing this type of anemia. It is the type produced by exposure to *x*-ray and radioactive materials.

Relationship of Indices to Various Types of Anemias

Index	Iron Deficiency	Anti-anemic Factor Deficiency	Normal Hemo-lytic	Marrow Damage
PCV	Low	Normal or low	Low	Very low
MCV	Low	High	Variable to high	Very low
MCH	Low	High	High	Normal
MCHC	Low	Normal	Normal	May be normal

Summary and Conclusions

Three commonly used laboratory procedures are discussed briefly with particular reference to interpretation. These tests are: White blood cell count, sedimentation rate, and packed cell volume. These are representative in their value to the veterinary clinician both for diagnosis and prognosis.

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Hemoglobin Determination†

C. E. BILD, D.V.M., Miami, Florida

Hemoglobin determinations have many positive clinical uses in small animal medicine. No reference will be made to severe hookworm anemia. A number of my friends answered a hemoglobin survey stating that since they did not have severe hookworm problems in their practices they did not make many hemoglobin determinations. I should like to state that hookworm anemia is not one of my serious problems either. It was said 60 years ago, and it is still pertinent today, that the most accurate method of determining the hemoglobin level is with a spectrophotometer[1,2].

Since this is a research routine, it is not practical for small animal clinicians. Our problem, as I understand it, is to have a method of determining the hemoglobin that is fast, inexpensive, and consistent. It must be accurate enough for clinical purposes.

For about seven years, I have used a Spencer hemoglobinometer[3]. This instrument will work with batteries or from a light socket. We use a light-socket adaptor. The operating cost is two cents per examination, which is the cost of a hemolysis stick. The instrument complete, sells for $61.50 in Miami and, in my estimation, is a satisfactory piece of equipment.

The time necessary for a hemoglobin determination, from start to finish, including the cleaning of equipment, is about two or three minutes. I have found my hemoglobinometer to be consistent, with different employees making repeated examinations of the same animal in check testing this routine.

The following are a few clinical thoughts with regard to hemoglobin determinations. Probably, the three most reliable, obtainable factors as to the growth and development of an animal are the serial recording of: (1) Hemoglobin, (2) weight, and (3) plasma proteins. Total plasma proteins, and/or albumin-globulin fraction determinations are too involved for routine small animal clinical use. However, we have in growing animals, two most reliable indicators of growth and development. These are the hemoglobin and the weight of an animal[4].

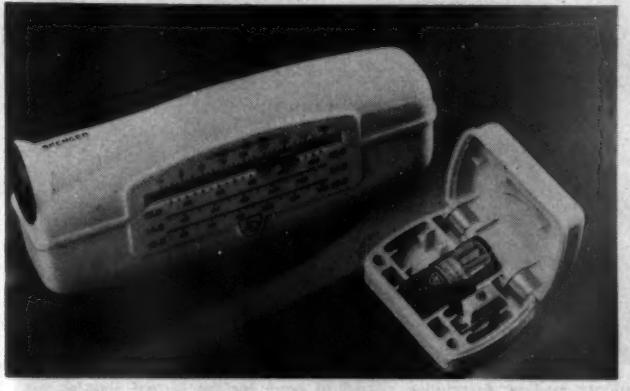
It is necessary that the weight and that the hemoglobin determination be made at the same time in every instance.

It appears at times that the puppy grows and the hemoglobin does not. I once believed that I could estimate quite accurately the hemoglobin of an animal, but I was in error. Often I was doubly wrong as I mixed guessing with hoping. The recorded weight and recorded hemoglobin are two important and positive clinical aids.

Any animal that is or has been sick is a good subject for recording both the weight and the hemoglobin level. An animal that has lost 10% of its body weight, and whose hemoglobin level remains the same, must be considered an animal that has a contracted blood volume of 10%.

In the problem of rehabilitation of an animal, it is necessary that both the weight and the hemoglobin return to what is considered normal for the particular situation and clinical instance in question. It seems that accompany-

†Presented at the 21st annual meeting of the American Animal Hospital Association, New York, May 5-8, 1954.



Spencer Hb Meter No. 1000. This instrument is scientifically designed for determining hemoglobin concentration in blood by its optical properties.

A drop of blood is placed on an exposed chamber plateau and agitated gently with a hemolysis applicator. Chamber is then pushed into a clip where it is held firmly as one unit. This is inserted in a slot for observation. The instrument depends on intensity match rather than color match utilizing light in the visible green spectrum. There are no dilutions or volumetric measurements necessary in making determination for diagnosis or continuous (daily) checks on the patient's condition and response to treatment. Accurate readings may be made in less than three minutes. Manufactured by American Optical Company, Buffalo 15, New York.

ing and/or following such stress factors as various infections, there is often weight loss, and accompanying hemoglobin loss. The weight loss usually is first. The same is true of many surgical problems which are stress situations.

Accompanying stress factors, there may or may not be such factors as less red cells being manufactured, and there is always a possibility that because of any stress, that more than the normal number of red cells are being destroyed.

In general, it may be stated that often weight loss and occasionally a hemoglobin deficit accompanies stress.

It seems to me that one of the most useful evaluations in clinical small animal medicine is the employment of serial hemoglobin determinations when they are accompanied by serial weight checks of the animal.

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Dr. Joseph E. Greer
1896-1955

Dr. Joseph E. Greer, KSC '25, Dublin, Virginia, died on Sunday January 9, 1955, after a lingering illness. Doctor Greer and his family had been made aware of the progressiveness of a fatal brain tumor over three months preceding his death. Diagnosis had been made at the Mayo Clinic in October 1954.

Doctor Greer established a general practice in Pulaski, Virginia in 1933. In 1949 he completed new facilities for hospitalization and treatment of both large and small animals in nearby Dublin. His influence as a professional man and good citizen was felt over the entire community in which he practiced. His death is a tragic loss to his many friends and to the profession in Virginia.

Services were conducted in the Episcopal Church of his home town where he served as vestryman.

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The national death rate in 1954, dropped to an all-time low of 9.2 per 1,000 population, 5% under the previous low point registered in 1953.

Officers of the Florida State Veterinary Medical Association elected to serve for the current year at the recently-concluded annual meeting at St. Petersburg include (l. to r.): Drs. Jack C. Knowles, Miami, president; Peter Ray, Jacksonville, vice-president; Ralph Porter, Quincy, treasurer, and Robert P. Knowles, Miami, secretary.

Technic of Determining Blood Urea Percentage†

C. E. BILD, D.V.M., Miami, Florida

The thermometer is a diagnostic aid, and it is necessary that each thermometer reading be evaluated. A radiograph is also an aid in diagnosis, and evaluation must be made here also. The determination of the urea content of the blood, likewise, is a diagnostic aid.

There are situations in small animal practice where the determination of the urea content of the blood is a worthwhile aid in diagnosis. I know of dozens of practitioners who make use of this test, and I do not know of a single practitioner who has given urea determination a good trial and then dispensed with it. I would like to quote Dr. Glen Lawhorn, a general practitioner for 35 years, who lives in a comparatively small town. He states: "If correlated with the clinical picture and other laboratory procedures, blood urea determination is probably one of the most useful tests available to the small animal practitioner. Its simplicity enhances its usefulness tremendously to the small operator who must either do his laboratory work himself, or entrust it to relatively untrained assistants."

Since elevated urea content of the blood means uremia, I should like to quote from the book The Kidney by Dr. Homer Smith[1]: "The term 'uremia' early became associated with renal insufficiency. It is now thought that few, if any, clinical signs and pathological changes associated with renal insufficiency are due specifically to the accumulation of urea in the body, for urea is one of the less toxic of all nitrogenous compounds, but this in no way diminishes the importance of the fact that the capacity to excrete it constitutes a valuable test of renal function."

I also quote from Nash's[2] Surgical Physiology, and from Byron Blade's revision of this book: "As a guide to loss of renal function, determinations of the blood content of urea, creatinine and NPN are valueless by themselves, for it has been shown by means of urea clearance tests that about 60% of the renal

†Presented at the 21st annual meeting of the American Animal Hospital Association, New York, May 5-8, 1954.

Lamotte Blood Urea Outfit

This apparatus was designed to furnish accurate data which may be desirable in the study of renal function. The procedure was developed by Philip S. Hench, M.D., and Martha Aldrich, B.A., of the Mayo Clinic, Division of Medicine, and reported in Archives of Internal Medicine, 38:474, 1926. Some minor modifications have been made, contributing largely to convenience in making determinations based upon the principle that mercury combines with such products as urea, creatinine, and uric acid, when a mercuric salt solution is added to substances containing these products. In patients suffering nephritis and retention of nitrogen, urea is the chief retained product.

The manufacturers have found, through research studies, that the blood of patients receiving sulfonamide compounds has a tendency to react with the blood urea reagent to give higher results than would be found otherwise. Allowance must be made if the patient has been receiving sulfonamide treatment.

The Lamotte blood urea outfit with reagents and refills and replacement is prepared by the Lamotte Chemical Products Co., Towson, Baltimore 4, Maryland.

function may be lost, before blood chemical findings become significantly abnormal."

One more quotation from the same book[3]: "The most exact and sensitive test of kidney function available is the blood urea clearance test." I know of no small animal practitioner who makes use of this urea clearance test.

I asked a dozen men who are familiar with the determination of the urea content of the blood, "How many determinations is it necessary for a practitioner to make before becoming clinically familiar with the test?" The opinions varied from 3 to 50.

Dr. Elliott Beamer stated: "I don't think you can put down a definite answer. The technic can be learned by running a few tests, but the ability to intrepret the results is entirely up to the individual, that is, his ability to recognize the clinical symptoms as such."

Because the mechanics of this test are simple, the cost negligible, and the time involved is only a matter of 15 to 20 minutes, I do not believe a single person who ever became familiar with it has since used a commercial laboratory for this routine, any more than I know of any practitioner who sends out fecal samples for hookworm examinations. One may learn this test for the urea content of the blood in a matter of a few minutes, but clinical application is another thing.

I believe one of the best uses of the determination of the urea content of the blood is in the diagnosis of leptospirosis. Usually, when there are clinical signs, and symptoms of this disease, there is an elevation of the urea content of the blood. This elevation does not occur in infectious hepatitis and distemper. Here the test is of diagnostic and prognostic importance. However, subclinical canine leptospirosis is not an uncommon condition in my practice[4]. The blood urea, or BUN, may be within the normal range, or it consistently may be elevated, say a blood urea of 50. The weight level is not always optimum but it is often consistent, and the same is true of hemoglobin level. As to be expected, these are evidences of kidney dysfunction.

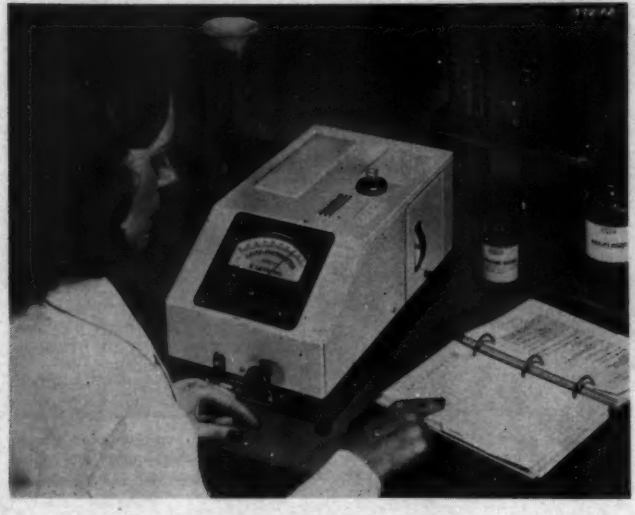
An excellent article with regard to leptospirosis and urea content of the blood is by John McIllnay,[5] of Omaha, and was published in the *Michigan State College Veterinarian* in 1948.

The test for urea content of blood has an occasional use in the clinical evaluation of nephritis in older animals. As stated, the determinations are only an occasional diagnostic aid, and it is necessary in the evaluation of clinical nephritis problems that the urine be examined. These diagnostic aids must be correlated with all obtainable contributing clinical and laboratory factors.

Directions for the LaMotte equipment routine for determining the urea content of the blood is outlined on page 135. This is a reproduction of the routine as given at the A.A.H.A. meeting in Pasadena, California in 1952[6]. I do not like this routine particularly, but I am familiar with it and it has served well in my practice. However, I intend to make more extensive use of a colorimeter in the near future.

Raw egg albumen may be used the same as

Colorimeter — Leitz Photrometer



Calibrated for 40 of the most common clinical tests, the Leitz photrometer (pictured here) is simple to operate, having only two moving parts. No special skills are required to use this instrument. Accompanying handbook contains outlines of standard clinical methods which any competent laboratory worker can follow satisfactorily. With each method there is a calibration table, thus eliminating need for calculation, preparation of standards or supply of standard solutions.

If it is desired to use the photrometer for special tests, it can be calibrated readily by technician in your own laboratory. Manufactured by E. Leitz, Inc., 468 Fourth Ave., New York 16, N. Y.

whole blood to run this test. With any routine, the urea content of raw egg albumen should read 12 mg. of urea per 100 cc. In order to familiarize oneself with the technic of the test, it is in order to use raw egg albumin, canned milk, or bottled milk, as a substitute for whole blood.

The figures obtained with these different products should be constant for each sample. One may use these standards to test new reagents and equipment. Normal blood urea for the dog is 15 to 35 mg. per 100 cc. of blood.

Determination of Urea Content of the Blood

Step 1. **LaMotte Equipment Routine**

Equipment and Reagents:

Potassium oxalate (2%)—anticoagulant
Trichloracetic acid (10%)—This is used to coagulate the proteins in the blood sample
Bichloride of mercury (5%)
Saturated solution of sodium carbonate
Two glass beakers, 30 or 50 cc.
Glass funnel
Filter paper—Whatman's No. 2
Porcelain spot plate
LaMotte buret.

Technic:

1. Put 0.5 cc. of potassium oxalate in a 50 cc. beaker.

2. Add 10 cc. of whole blood and stir.

3. Add 10 cc. of 10% trichloracetic acid and stir. One should use exactly the same amount of blood and 10% trichloracetic acid.

4. Filter. One may use a centrifuge and centrifuge the above mixture instead of filtering. The use of the centrifuge saves a little time, and it takes a little less blood when the centrifuge is used. In some instances where there is not too much hemoconcentration of the blood, one may use 6 cc. of whole blood and 6 cc. of the above acid.

5. Need 5 cc. of filtrate. This is a clear, colorless, and protein-free filtrate.

6. Fill buret with the bichloride of mercury solution ($HgCl_2$) to the top or "mg." mark.

7. Put a drop of the saturated solution of sodium carbonate on each indentation of the spot plate. A small eye dropper bottle works better than a glass stoppered dropper bottle as it uses a smaller drop of sodium carbonate.

8. Begin titration. Put 5 cc. of filtrate in a glass beaker, and add the $HgCl_2$ from the buret from the top mark mg. to mark 00. Stir. Add a drop of this filtrate and $HgCl_2$ mixture to the spot plate—no precipitate. Add the $HgCl_2$ from the buret to the filtrate mixture down to the mark 10 and stir. Add a drop of this mixture to one of the drops of sodium carbonate, et cetera, until positive, *i.e.*, there forms within three seconds a slight reddish brick-like precipitate when a drop of the filtrate mixture and sodium carbonate are mixed on the spot plate. In high urea determinations a yellowish precipitate forms early and is not positive.

Appropriate blood urea nitrogen (BUN) values may be obtained by multiplying the blood urea figure by the factor .46.

Step 2. **Buy a colorimeter**

Addendum

Since writing the above article a little more than a year ago, the writer has taken step 2 and acquired a colorimeter and now makes blood urea nitrogen (BUN) determination. The blood urea factor may be obtained by multiplying the BUN by 2.14.

Hemoglobin determinations with our colorimeter are consistent and satisfactory. Total time involved from starting with blood to cleaning equipment is less than two minutes. Now we make about half our hemoglobin determinations with a Spencer meter and half with a colorimeter. The Spencer meter and colorimeter are consistent with each other.

REFERENCES

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2. Nash, Joseph, Surgical Physiology, Springfield, Ill., C. C. Thomas Publishing Co., 1950, p. 265.
3. Ibid., p. 264.
4. Bild, C. E., The Use of the Urea Content of the Blood in the Diagnosis of Leptospirosis of the Dog. Proceedings Book, A.V.M.A., Toronto, Ontario, Canada, 1953, p. 252.
5. McIllnay, J. N., Methods of Diagnosis of Leptospirosis in Dogs. *M.S.C. Vet.*, 9:2, 1949.
6. Bild, C. E., Urea Content in the Blood, A.A.H.A. Proceedings Book, Pasadena, 1952.

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The insecticide malathon in 2% strength applied topically to dogs suffering pruritus was followed by excellent results. In these cases no skin parasites were demonstrated. Since the toxicology of malathon is not yet fully understood it has not been released for use on dogs.—*Kansas Conference Notes.*

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When breeding females are presented for diagnosis and treatment for failure to conceive at repeated service, pathologic conditions must be searched for and ruled out before instituting treatment designed for functional infertility.

Treatment of Anal Tumors In Aged Dogs

R. L. DUMAS*, D.V.M., Waterbury, Vermont

When injected, cyclopentylpropionate ester of alpha estradiol (ECP)® slowly releases the parent substance into animal tissues. This hormone has been described as the most potent of the naturally-occurring estrogens. Esterification of alpha estradiol causes more efficient estrogen utilization, with enhancement and prolongation of effect.

ECP contains in each cc., estradiol, 17-cyclopentylpropionate, 2 mg.; chlorobutanol, 5 mg.; and cottonseed oil, q.s. It is intended for intramuscular use in large and small animals. Primary indications for its use have been those where prompt initiation and maintenance of estrum is desired, especially in treating anestrum.

Since initial application in canine anal adenomas by another worker[1], the author has had opportunity to apply the product in three canine geriatric patients. This article confirms the findings of the original worker.

Case Histories

Case 1. A 13-year-old Cocker Spaniel was admitted for examination in January, 1954. This male dog exhibited multiple perianal tumors. Some of these had raw external lesions resembling granulation tissue.

ECP, 1 cc., was injected intramuscularly and the dose was repeated in six days. No topical therapy was employed.

Two weeks after initiating treatment, the lesions were dry and healed. Injection was repeated. The following week, small tumors had disappeared and the larger ones were in the process of degenerating. At this time, a third injection was administered. This was repeated in two weeks, at which time all tumors had disappeared.

A month later, perianal region appeared normal. In June, 1954, the patient died of an unassociated virus infection. Postmortem examination disclosed no reappearance of growths.

Case 2. An 11-year-old, male, Cocker Spaniel was presented for treatment. Examination revealed multiple perianal tumors, none of which were abraded. Treatment was administered as in case 1, until the fourth injection was reached. At the time of this visit, the owner complained of urinary incontinence. To counteract this side action, depo®-testosterone cyclopentylpropionate, 1 cc., was injected intramuscularly. Incontinence ceased in 36 hours.

The tumors began to degenerate after the third injection of ECP and had disappeared completely after the fourth injection. The patient was examined a month later. There had been no reappearance of the tumors or the incontinence.

Case 3. This patient was an 11-year-old Cocker Spaniel with multiple anal tumors. These presented no raw lesions. Two 1 cc. injections of ECP were administered one week apart. The owner did not submit the animal for examination until three weeks later. The tumors had completely degenerated and two months later had not reappeared.

Discussion

Current therapy for anal adenoma is far from satisfactory. While initial lesions are essentially nonmalignant, control of rupture, hemorrhage, and infection pose secondary problems. The tumors apparently have the potential to become malignant. Total extirpation is difficult and tedious surgery usually performed on grossly contaminated and often deeply infected tissues. In addition, the condition and age of the usual patient presents anesthetic and surgical risks. Deep x-ray therapy has been of benefit in certain cases, but is not available to all practitioners.

It is interesting, but probably not significant, that all cases here reported were elderly Cocker Spaniel males. The report of the previous worker also includes one member of this breed, and all of his patients were confined to geriatric cases. Occurrence in male dogs also has been noted.

Use of ECP is indicated in this otherwise often refractory and troublesome condition.

Summary

ECP (estradiol, 17-cyclopentylpropionate) was administered to three elderly male dogs with multiple anal adenomas. Injections in series beneficially affected all cases treated.

REFERENCES

1. Miller, S. S., The Use of ECP® For Anal Adenoma In Three Aged Dogs: A Preliminary Report. *Vet. Med.*, 49:41 (Jan.), 1954.

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Positive diagnosis is largely dependent on accurate laboratory service that is sufficiently complete to be conclusive.

*Dumas Veterinary Hospital, Waterbury.
®The Upjohn Company, Kalamazoo, Mich.

Guinea Pigs

The guinea pig is discussed by Heman L. Ibsen, Kansas State College, Manhattan*. These little mammals, called cavies by fanciers, originally came from South America. There are four varieties: English, smooth short-hair; Abyssinian, rough short-hair; Peruvian, rough long-hair, and an unnamed variety having long hair that lies smoothly. Peruvian Indians have developed a large type which they raise for food.

The estrual cycle is about 16 days and the gestation period is long in the guinea pig — 62 to 72 days. This is in contrast with 21 days in mice and rats and 32 days in rabbits. The young are well developed when born. Females usually are bred before they are 30 days of age and sometimes as early as 20 days. The males, however, are not sexually mature until they are about 70 days of age. It takes 15 months for the guinea pig to attain its full growth. The female will mate within a few hours after parturition and as many as seven litters may be obtained, only a gestation period apart, from a normally growing female. Mature females weigh from 700 to 1,300 gm. and males from 800 to 1,500 gm.

At birth, the young weigh 40 to 140 gm., but few weighing less than 60 gm. survive for long. At birth the eyes of guinea pigs are open. The young are covered with fur and provided with teeth. Even when no milk is supplied by the dam, most of the newborn will survive on the food of adult animals. Litters vary in number from one to six or more. The survival rate is low in large litters and breeders prefer not more than three or four to the litter. The guinea pig has but two functioning mammae.

Guinea pigs are unable to climb and can jump but little. An enclosure two feet high will contain them. All males and exceptional females will fight when placed with others. They are more noisy than other rodents.

Although readily inoculated with anthrax, tuberculosis, rabies, brucellosis, equine encephalomyelitis, et cetera, they are not prone to acquire infections naturally. If improperly fed, they are highly susceptible to intestinal ailments.

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Each protein feedstuff has its definite amino acid composition.

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*The Care and Breeding of Laboratory Animals, edited by Edmond J. Farris. John Wiley & Sons, Inc., New York.

American Animal Hospital Association Announces Annual Meeting Plans

The 22nd annual meeting of the American Animal Hospital Association will be held at Hotel Statler, Detroit, Michigan, May 4-7, 1955. The annual golf tournament will be played on Tuesday, May 3rd. A business meeting for members will be held on Wednesday, May 4th.

Dr. Charles W. Bower
President of the A.A.H.A.

Scientific sessions, open to all veterinarians, will begin on Thursday morning, May 5th and will continue until Saturday noon, May 7th. All interested veterinarians are invited to attend. A variety of subjects will be discussed, with emphasis on television demonstrations, which again will be sponsored by Pitman-Moore Company and Radio Corporation of America.

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Guy Lombardo, popular orchestra leader, is the 1955 chairman of National Dog Week, September 18-24, 1955 sponsored by the National Dog Welfare Guild.

Mr. Raymond J. Hanfield, executive secretary, 114 East 32nd St., New York City, outlines the objectives of Guild activities as general welfare of all dogs, promotion of fair dog laws, research in diseases, and better informed dog owners.

Human Rabies Deaths In The United States

Although the annual number of human deaths from rabies in the United States is small, the majority of these deaths occur among youngsters. The age group most vulnerable is the 5-14 year group, followed by the group under five years of age.

Rabies deaths by age groups for the years 1943-1951 show that 20% of these deaths occurred among children in the 5-9 year group, 19% in the 10-14 age group, and 13% among children under five. Thus, children under 15 years of age account for more than half of the total deaths from rabies; age 15-49 years, 35%; and oldsters 50 years and more account for the remaining 13%.

The accompanying table shows rabies deaths in the United States during the years 1943-1951:

Age, Years	'43	'44	'45	'46	'47	'48	'49	'50	'51	Tot.	% Tot.
Under 5	5	6	6	4	6	4	1	1	4	37	13.4
5-9	12	8	6	9	4	2	4	6	4	55	19.9
10-14	10	9	10	4	5	3	2	6	2	51	18.5
15-19	2	5	2	3	1	2	1	..	2	18	6.5
20-24	1	1	1	5	1	1	1	1	1	13	4.7
25-29	2	3	3	2	2	..	..	..	2	14	5.1
30-34	1	3	2	3	3	2	..	1	..	15	5.4
35-39	2	2	1	1	1	2	..	3	1	13	4.7
40-44	1	3	5	2	..	1	..	..	2	14	5.1
45-49	2	4	1	1	..	3	..	..	..	11	4.0
50-54	2	3	2	..	..	1	..	..	..	8	2.9
55-59	1	3	2	..	2	..	1	..	..	9	3.3
60-64	3	1	..	..	1	2	..	..	..	7	2.5
65-69	..	2	1	..	..	..	..	..	..	3	1.1
70-74	2	1	..	..	..	..	..	..	..	3	1.1
75-79	1	1	1	..	..	..	..	..	..	3	1.1
80-84	..	1	..	..	..	..	..	..	..	1	0.4
85-89	..	..	..	..	..	1	..	..	..	1	0.4
Total	47	56	43	34	26	24	10	18	18	276	100.0

Prepared by Statisitcs Section, Epidemiology Branch, CDC, from data furnished by the National Office of Vital Statistics.

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Fragmentary knowledge of fungous diseases and the rather involved technics for their diagnosis, identification, and culture may be the reason for past recorded low incidence. The situation suggests, as more is learned about these disease-producing agents, that mycotic diseases are common and frequently confused with a number of entities. Furthermore, incidence of these conditions in both man and animals appears to be increasing, perhaps only as diagnostic technics are improved.

Poisonous Toads

The "superstition" that toads are poisonous is a solid scientific fact. Dogs, especially, are subject to the poison which commonly produces vomiting and some degree of heart failure as symptoms*. Contact either with the skin of the toad, or parotid secretions may cause poisoning. Toad-poisoned dogs may remain unconscious or semiconscious for hours, but seldom die if given supportive treatment—provision of warmth to maintain body temperature. Epinephrine appears to help in restoring consciousness. The author (British) reports he finds no mention of such cases in veterinary literature. He discusses toad poisons by delineating their physiological activities.

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Dr. Thomas G. Beard Victim of Leukemia

Dr. Thomas G. Beard, COLO. '27, Los Angeles, California, died after an illness extending over a six-month period. Doctor Beard had suffered extensive lesions on his hands for some years due to *x*-radiation thought to be the ultimate cause of his death.

Born in Lakota, North Dakota, in 1903, Doctor Beard received his veterinary training at Colorado A. and M. College. He became associated with Dr. John McKenna, formerly director of the Ambassador Animal Hospital, Beverly Boulevard, in Los Angeles and upon the death of Doctor McKenna he, in partnership with Dr. Robert T. McLean, purchased that property and practice from Mrs. McKenna. The partnership was dissolved in 1953.

Doctor Beard fostered the J. Wells Smith $13,000. fund established at the Colorado school for research in animal disease. This became known as the Beard Fund for Animal Research.

Surviving are his wife, Christine, twin daughters, Lola and Lucille, both students at San Jose State College, and his mother, Mrs. Leslie Strawn.

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A person realizing his limitations probably will prosper. He knows that he can not be proficient in everything and concentrates on only a few. Competition is severest among jacks-of-all-trades and masters-of-none.

*Smythe, R. H., The Toxic Food. *Vet. Rec.*, 65:468 (July 25), 1953.

Effect of the "B" Virus (Strain No. 1) in Young Kittens

REGINALD L. REAGAN*, Major Ret. U. S. A., EDWARD C. DELAHA**, B.S., SUE R. COOK***, B.A., and ARTHUR L. BRUECKNERt, V.M.D., College Park, Maryland

The "B" virus (strain no. 1) was isolated from the spleen and central nervous system of patient B and maintained since the original isolation in 1932 by serial passage in rabbits. The virus is extremely pathogenic for rabbits by most routes of inoculation. Following intracutaneous injection, a hemorrhagic necrotic area develops around the site of inoculation. About one to two days before paralysis occurs, most rabbits exhibit a tendency to bite the local lesion[1]. The present study was undertaken in order to find the susceptibility of young kittens, when exposed by various routes, to the rabbit-adapted "B" virus strain.

Materials and Methods

The "B" virus (strain no. 1) employed in this study was furnished by the American Type Culture Collection in Washington, D. C. This virus was obtained originally by the above institution from Dr. Albert B. Sabin of the Children's Hospital in Cincinnati, Ohio. Before receipt at this laboratory, the virus had been passed 67 times in rabbits. Lyophilized rabbit spinal cords of the 67th rabbit passage were received at this laboratory and diluted to a 1/50 suspension with physiological saline.

Two albino rabbits (weight 3 lb.) were inoculated intradermally with 0.1 cc. of this 1/50 suspension. The rabbits showed paralysis, a hemorrhagic necrotic area around the site of injection, and nervous symptoms within five to six days. This verified that the original virus was viable after five years in the lyophilized state.

Twenty kittens (1 lb. each) were divided into five groups of four kittens each. The four cats of each group were administered the rabbit cord virus suspension by one of the following routes: Intracerebral, intradermal, intramuscular, intrarectal, and intranasal. The inoculum consisted of 0.1 cc. of the suspension for all routes except the intracerebral and the intranasal where the inoculum was 0.06 cc. After inoculation all groups were observed twice daily for nervous symptoms characteristically found in mammals infected experimentally with "B" virus.

After the appearance of nervous symptoms and paralysis the animals were sacrificed, their brains were removed aseptically, each group was pooled and frozen in a -52 C. deep freeze storage vault. Two days later the brains from all groups were removed from the deep freeze, thawed, ground with sterile alundum, and made into 10% suspensions with physiological saline.

The virus contained in the brains of the kittens that showed symptoms of central nervous system involvement was confirmed to be "B" virus by means of neutralization tests using normal and hyperimmune rabbit sera. Rabbits were used as the test host and were injected intradermally.

Results

Table 1 shows the response of young kittens to the rabbit-adapted "B" virus (strain no. 1) after inoculation by different routes. The incubation period in the young kittens was from five to seven days; the period varied slightly with the route of exposure. Five to six days postinoculation five rabbits, which had been inoculated dermally with the brain suspensions from one of the cat groups, showed the typical dermal lesions characteristically found in "B" virus infection. Another five rabbits were inoculated dermally with the respective kitten brain suspensions after exposure to "B" virus hyperimmune sera. These rabbits failed to develop "B" virus dermal lesions. This verified that the cats had been infected with the "B" virus.

TABLE 1. Response of Young Kittens to "B" Virus (strain no. 1)

Routes	No. cats exp.	No. showing symptoms	Min. to Max. Incub. period (days)
Intrarectal	4	4	5
Intradermal	4	4	5
Intramuscular	4	4	6
Intracerebral	4	4	7
Intranasal	4	4	7

Summary

Twenty kittens were divided into five groups of four kittens each. The four cats of each group were administered the rabbit-adapted "B" virus by one of the following routes: Intracerebral, intradermal, intramuscular, intrarectal, and intranasal. Within five to seven

*Professor of Virus Diseases;
**Virologist;
†Professor and Director of Live Stock Sanitary Service, Virus Department, Live Stock Sanitary Service Laboratory, University of Maryland, College Park, Md.

The authors wish to thank Mr. Vernan Hussman for his technical assistance.

days all of the cats of all groups evidenced symptoms characteristically found in mammals infected experimentally with the "B" virus. After the appearance of symptoms the animals were sacrificed, their brains were removed, each group was pooled, and made into a 20% suspension. Each of the five suspensions was inoculated dermally into a rabbit which developed characteristic "B" virus dermal lesions within five to six days. Another five rabbits were inoculated dermally with the respective kitten brain suspensions after exposure to "B" virus hyperimmune sera. These rabbits failed to develop "B" virus dermal lesions. This verified that the cats were infected experimentally with the "B" virus by all five routes of inoculation and that kittens are as susceptible to the virus as rabbits.

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1. Sabin, A. B., and Wright, A. M., Acute Ascending Myelitis Following a Monkey Bite, with the Isolation of a Virus Capable of Reproducing the Disease. *Jour. Exp. Med.*, 59:115, 1934.

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Chlorophyllin Found to Inhibit Hemagglutination Caused by Newcastle Disease, Mumps, Influenza Viruses

Chlorophyllin has been found to inhibit agglutination of chick red blood cells by the viruses of influenza, mumps, and Newcastle disease.

It is generally accepted that agents which thwart this activity of viruses may simultaneously check their infectivity.

Chlorophyllin apparently accomplishes this by a direct effect on the viruses as well as by preventing the viruses' occupation of red blood cell receptor sites.

Dr. Wolcott B. Dunham of the General Medical Research Laboratory of the Veterans Administration Medical Teaching Group Hospital, has reported on his experimental work with chlorophyllin and viruses in a paper published in *Pro. Soc. Exp. Biol. & Med.*, 87:431, 1954.

In the experiment, solutions of copper chlorophyllin inhibited agglutination of chick red cells when the viruses were used in partially purified suspensions and also when they were precipitated with methanol and washed.

All of 11 copper chlorophyllin samples provided by Rystan Company, Mount Vernon, N. Y., inhibited hemagglutination by viruses of the three diseases.

The sample selected by Doctor Dunham for thorough testing showed no undesirable effect on the cells regardless of the concentrations used.

The author emphasizes the increasing order of effectiveness against influenza, mumps, and Newcastle disease viruses. This finding is in accordance with an order of activity established for the three viruses; the influenza virus is most active in occupying red cell receptor sites, and mumps and Newcastle disease are less active, respectively.

Part of the effect was exerted immediately or within one-half minute of the time a virus and chlorophyllin were mixed with one another. However, the effect increased with increased time of exposure, Doctor Dunham suggests, therefore, that a virus itself, as well as the blood cell, undergoes change. He points out that chlorophyllins have been found to inhibit hemagglutination by a variety of unrelated substances, in addition to these three viruses.

Chlorophyllins have been found to be suitable for injection and to be free of side effects. This work suggests they can modify viral infections. Thus they may prove useful in prophylaxis or treatment of viral diseases, either as additives for vaccines or as actual viral vaccines when combined with live virus.

The chick red cell system, with which Doctor Dunham's work is concerned, is commonly used for assay of viruses and screening of antivirals. It is also used for the detection of antibodies in the serum of immune subjects. The ability of serum to inhibit hemagglutination is taken as evidence of immunity.

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Hydrocortisone has proved to be vastly superior to cortisone for treatment of diseases of the eye.

When used topically, strength of solution recommended is 0.5 to 2.5 mg. per cc. Use drops persistently at hourly intervals for eight hours and then lengthen interval and reduce size of dose. Ointments containing hydrocortisone may be instilled three times daily.

Subconjunctival injections have given most satisfactory results when treatment is administered to hospitalized patients every two or three days. In this case 0.25 to 0.5 cc. of a sterile solution containing 25 mg. per cc. is employed.—*William G. Magrane, D.V.M.*

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Species of wild hogs are found on every continent except Australia.

Infertility in Dairy Cattle

(*Continued from page 124*)

or pensulmycin®[6] in these cases.

Pyometra cases following calving in which the cervix has contracted to the point where a 240 gr. sulfanilamide bolet®[5] can not be inserted, respond favorably to the introduction of the 500 mg. oblets of polyotic®[4] terramycin,®[5] aureomycin,®[4] gammamycin®[6] or streptomycin. We infuse some of these cows as a follow-up treatment before breeding. Usually this is done a few weeks later or at the next visit, preferably during the estrual phase.

Trichomoniasis should be suspected in pyometra cases observed after cows have been bred for two or more months. If the pus has a milky color and contains small granular lumps, it is almost pathonomonic of trichomonad infection. Microscopic examinations of the material made within four hours after collection will reveal the live protozoa.

Occasionally we find other pyometra cases in which other infections, notably corynebacterium organisms, appear to be the responsible agents. These we have found relatively difficult to treat. We have had success in clearing up a limited number of cases following the daily administration of a pint of benemid®[3] orally and 3,000,000 units of procain penicillin intramuscularly, at intervals of 24 hours, for a period of seven days.

Some Observations on Abortions

Even though there is significant evidence that infections play an important role in the early death of the embryo, it is possible that hormone imbalance or insufficiency also may be responsible for some early fetal deaths. Present knowledge indicates that the causes for most abortions are brucellosis, trichomoniasis, leptospirosis, and other local infections of the reproductive tract. In addition, there are a variety of other causes such as poisons, cystic degeneration, fertilization with imperfect or immature ova or sperm, and possibly inadequate hormone production, particularly progesterone.

We treated several selected cases of so-called habitual aborting cows with repositol®[2] progesterone with encouraging results. Conclusions can not be drawn from the limited number of cases treated, however, it is possible further research will demonstrate that certain abortions may occur as a result of inadequate production of this hormone.

®[4]Lederle Laboratories Division, Pearl River, N.Y.
®[5]Chas. Pfizer & Co., Brooklyn, N.Y.
®[2]Pitman-Moore Co., Indianapolis, Ind.
®[6]Norden Laboratories, Lincoln, Neb.

Congenital Abnormalities

Congenital abnormalities of the reproductive tract according to our findings are not numerous. Those abnormalities most frequently found are cervi with double openings of the os on the vaginal end, the presence of partial hymen, absence of one horn, (unicorneal uterus) and the absence of one or both ovaries. Our records reveal less than one out of approximately 1,000 cases show this abnormality. The absence of ovaries, together with partial or complete absence of the uterus, is seen most commonly in freemartins.

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Carrion Feeding Birds as Disseminators of Diseases

In the June 1952 issue of VETERINARY MEDICINE (vol. 47, p. 253) I discussed the role of carrion-feeding birds as disseminators of anthrax as quoted by Morris in Louisiana Agr. Exp. Sta. Bul. 136. Another reference on this subject which is recommended for reading is, Dissemination of Animal Disease in India — Role of Man and of Carrion Feeders, by Minett in *The British Vet. Jour.*, 110 (1):19 (Jan.), 1954. Minett describes the role of vultures in disposal of carcasses and gives a number of additional references on the subject. In India, the common practice when an animal dies is to call a "chamar" or low class trader in skins and meat. He transports the dead animal to a spot a mile or so from the village, skins it, and leaves it for vultures and other carrion-eating animals. In many instances all the meat of a carcass of a buffalo, for example, will be eaten by vultures within 15 to 30 minutes. The bones are then collected and sold. The author gave no definite instances of transmission of disease by carrion feeding animals. The author says that the danger of spreading disease by carrion-feeders in India is probably greatly outweighed by the effectiveness with which they keep the country free from putrefying carcasses.— *W. R. Hinshaw, D.V.M.*

Subcutaneous Implantation of Antibiotics in Pellet Form to Stimulate the Growth of Range Lambs and Range Calves†

G. W. ROBERTSTAD, B.S., M.S., R. SULLIVAN, B.S., M.S., J. O. TUCKER, M. S., D.V.M., and M. W. GLENN, D.V.M., Laramie, Wyoming

During the past ten years, antibiotics have been used effectively as chemotherapeutic agents. More recently, however, various investigators have reported that growth stimulation has been obtained with a number of different members of this group of agents.

Heuser and Norris[1] reported that the addition of penicillin, aureomycin®[1], terramycin®[2], and bacitracin to chick-starting rations increased weight gains. Matterson *et al.*[3] supplemented an all-plant protein ration and an all-plant protein ration in which 2.5% fish meal replaced a like amount of high-protein soybean oil meal with five antibiotics — aureomycin, streptomycin, penicillin, terramycin, and bacitracin. Of these, streptomycin was the least effective in promoting growth responses in chicks. The greatest percentage of growth response with antibiotics was obtained on the poorer quality rations. The greatest weight was obtained on the better quality rations. When the ration contained fish meal, penicillin and bacitracin appeared to act differently from other antibiotics in that they maintained an increased growth response over the unsupplemented basal for a longer period.

Branion *et al.*[3] determined the effect of subcutaneous implantation of a pellet containing 1,000 units of bacitracin with chicks. The results revealed that subcutaneous implantation of antibiotic, in pellet form, had no effect upon the body weight at six weeks.

Noland *et al.*[4] implanted bacitracin subcutaneously in suckling pigs and reported an 11.3% increase in weight of pigs weaned at 56 days.

Richard and Dinusson[5] concluded that implanting 1,000 units of bacitracin under the skin in the head region of growing and fattening lambs failed to improve the rate of gain. They also found that the economy of gain was lessened by the implantation of antibiotics.

†Supported in part by the Commercial Solvents Corporation. Published with the approval of the Director of the Wyoming Agricultural Experiment Station, as Journal Paper No. 50.

®[1]Lederle Laboratories Division, Pearl River, N.Y.
®[2]Chas. Pfizer & Co., Brooklyn, N. Y.

Methods and Results

It was the purpose of this experimental work to determine whether the subcutaneous implantation of bacitracin pellets was beneficial by increasing weight gains in range calves and if, alone or in combination with penicillin and neomycin, it would increase weight gains in range lambs.

Experiment 1. A total of 121 Hereford calves were used. Of these, 63 were controls and 58 were implanted with four pellets of 1,000 units of bacitracin each in the neck region within 12 hours of parturition. All animals were weighed at parturition, at branding (one to two months of age), and at shipping (five to six months of age).

A summary of the average weight gains is given in tables 1 and 2.

TABLE 1. Summary of Calf Weights at 1 to 2 Months of Age

Treatment	No. of* calves	Mean weight gain lbs.	% increase in weight over controls
None (control group)	63	58.00	——
4,000 units of bacitracin	58	64.4	11.03

These data were subjected to analysis of covariance to remove the effect of initial weight. This analysis indicates that the results were significant at the 0.10 level of probability.

TABLE 2. Summary of Calf Weights at 5 to 6 Months of Age

Treatment	No. of* calves	Mean weight gain lbs.	% increase in weight over controls
None (control group)	51	234.47	——
4,000 units of bacitracin	43	242.72	3.5

*The apparent discrepancy in number is due to the death of 10 calves while on mountain pasture, resulting from various causes; the remainder had strayed and were not available.

These data were subjected to analysis of covariance. The weight difference was not significant.

Experiment 2. A total of 496 lambs, ranging in age at the time of treatment from one to three weeks, were used. Of these, 141 received six pellets of bacitracin, a total of 6,000 units; 114 received four pellets of a bacitracin-neomycin combination containing a total of 3,000 units of bacitracin and 4,000 units of neomycin; 119 received five pellets of a bacitracin-penicillin combination containing a total

of 2,500 units of bacitracin and 25,000 units of penicillin; 122 served as uninoculated controls. The results are tabulated in table 3.

TABLE 3. Summary of Lamb Weights Four Weeks After Initiating Treatment

Group	Treatment	No.	Mean weight gain lbs.	% increase in weight over controls
A	6000 u. Bacitracin	141	16.631	——
B	3000 u. Bacitracin 4000 u. Neomycin	114	16.754	——
C	2500 u. Bacitracin 2500 u. Penicillin	119	16.512	——
D	None (control group)	122	16.967	——

The results indicate that none of the treated groups increased in weight over the control group.

Conclusion

Under range conditions, the concentrations and combinations of antibiotics used in this experimental work did not produce weight gains in lambs and calves of any value to the sheep and cattle rancher.

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Neomycin Sulfate in Arizona Paracolon Infection of Calves

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Bakersfield, California

Since reporting use of neomycin sulfate in *Salmonella dublin* infection of dairy calves,[1] the author has had opportunity to employ neomycin therapy** in an outbreak of Arizona paracolon infection of beef calves. This report serves as a supplement to the original article†.

Arizona Paracolon

Paracolon bacilli are colon-like organisms which occupy a position between the true colon bacilli and the pathogenic Shigella organisms. Arizona-type paracolon was originally isolated from horned lizards, Gila monsters, and chuckawallas[2] (Caldwell and Ryerson, 1939). It has since been found to produce fatal disease in snakes,[3,4] chickens, and turkeys,[5,6,7] and diarrhea in infants[8] and adults[6]. It was incriminated in an outbreak of food poisoning in Australia,[6] and it is significant that 121 of Edward's 456 cultures were grown from egg powder[6].

Foregoing data support the view that Arizona paracolon is widespread among animal species, as well as suggesting a definite threat to human health through animal-man transmission[8,9]. It is considered one of the most pathogenic of the paracolon group.

Calf Outbreak

Symptoms. Infection occurred in a herd of 20, two to ten-day-old Hereford calves. The initially-infected three that sickened overnight, demonstrated extreme depression, and had watery stools. The herdsman's routine use of a kaolin and pectin preparation and injections of a penicillin-dihydrostreptomycin combination proved ineffective, and these calves died. Professional assistance then was sought.

The remaining 17 calves sickened during the following ten days, demonstrating depression, fetid watery diarrhea, inappetance, and subnormal temperatures ranging from 99 to 100.5 F. One calf, however, had a temperature of 104.5 F. There were no pneumonic symptoms.

*Director, Bakersfield Veterinary Hospital.

**Mycifradin® Sulfate Tablets, 0.5 gm., The Upjohn Company, Kalamazoo, Michigan.

†The author wishes to acknowledege cooperation extended by Dr. Kenneth B. Haas, Department of Veterinary Medicine, The Upjohn Company, and Dr. William W. Worcester, State Pathological Laboratory, Fresno, California.

Diagnosis. Autopsy was performed on one of the originally-infected calves. Enteritis was pronounced. A segment of the intestine was submitted to the State Pathological Laboratory, Fresno. They reported isolation of an Arizona strain of paracolon organism and this was considered the causative factor.

Treatment. Neomycin sulfate therapy meanwhile had been started in the remaining 17 calves. This consisted of a 0.5 gm. neomycin tablet (mycifradin sulfate, Upjohn) initially, then one daily for two days. These calves made a dramatic recovery. Appetites and temperatures were normal the following day; stools formed in 18 to 36 hours.

Summary

Arizona paracolon organisms are believed to have been the cause of a serious outbreak of infectious enteritis in a group of 20 calves. Neomycin sulfate, 0.5 gm., tablets successfully controlled the disease. All treated calves recovered.

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Pfizer Wins Patent Rights

A patent on the newest antibiotic, tetracycline, has been granted Chas. Pfizer and Co., Inc., Brooklyn, N. Y. Four competitors have been involved in suits for patent infringements involving the new agent.

Lederle Laboratories, Pearl River, N. Y., also competing for patent rights entered into an agreement with Pfizer early last year, whereby whichever firm won the tetracycline patent would immediately license the other to manufacture the item.

Selenium Poisoning

Selenium toxicosis has been studied by various workers in different parts of the world as it occurs in both man and animals.

Shale soils have a high content of selenium and plants, under certain favorable conditions, absorb varying amount.

Under extreme conditions, ordinarily harmless plants may become toxic for cattle, sheep, swine, or horses. Many common plants have been incriminated as seleniferous, including wheat, corn, and barley.

Symtomology exhibited by animals which have been poisoned by selenium-containing forage is outlined (*The Indian Veterinary Journal*, 31:210 [Nov.], 1954) as follows:

(1) Garlic-like or arsenic-like odor of the breath.

(2) Cattle, sheep, horses, and pigs exhibit hoof abnormalities which impair movement, malaise, anorexia, stunted growth, loss of hair (especially of the tail and mane in horses), loss of weight, emaciation, impairment of fertility, and severe enema which is followed in succession by exhaustion, toxemia, and death.

(3) Autopsy reveals erosion of the extremities of the weight-bearing long bones, necrosis and regeneration of hepatic parenchyma with hemorrhage and secondary inflammation of the lungs and kidneys.

(4) Reduced selenium is found in the liver and spleen and compounds of this metal in all tissues, secretions, and excretions.

(5) Impairment of fertility of chicken eggs and reduced livability of chicks characterize the poisoning in this species.

Minute quantities, 4 mg. of sodium selenite or selenate per kilogram of body weight, either by oval, hypodermic, or rectal administration is fatal to dogs within a few minutes.

Treatment in early stages by supply of a sulfur rich diet and dried yeast may be rewarding though unsuccessful in advanced cases. Keeping animals from areas where seleniferous plants are known to exist is the principle means of control.

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New Movie on Avian Tuberculosis

"Vicious Circle" is the title of new motion picture just released by the U. S. Department of Agriculture. It portrays the avian type of tuberculosis, is a 16 mm. sound and color, and has a running time of 21 minutes. It is available from extension service and state college film libraries.

EDITORIAL COMMENTS

Hormones for Growth and Fattening

Interest in hormones for addition to feed supplements or for injection is intense. Feeders are seeking information from every source available. In some instances, it is understood that no restraint is exercised in advising their use. In previous issues of this journal (see VETERINARY MEDICINE 50:87 [Feb.], 1955) caution has been suggested on the basis that insufficient studies have been conducted on which to base confident conclusions.

Stilbestrol, a synthetic chemical substance having strong estrogenic properties, is a potent agent the physiological actions and side actions of which have been the subject of extensive research for several years. Parallels are drawn of its behavior to that of natural estrogens. Certain basic facts of endocrinology have been well established which includes the knowledge that hormones are delicately balanced in the normal healthy animal. All of what may happen under conditions of hormonal imbalance is not clear. Evidence has been presented that under extra estrogenic influence gonadotropic factors of the pituitary gland are stimulated which in turn may serve to increase the activity of adrenal cortices for the production of androgens and other products. In any event, the animal organism receiving hormone stimulation differs from the untreated.

From the public health standpoint, too little convincing information is available that meat from hormone-fed steers and treated lambs is a safe food for all ages of human beings. Tests so far have not demonstrated presence of estrogenic substances in edible tissues but exhaustive research, which is sorely needed, has not been made for the detection of other hormones resulting from estrogenic stimulation or degradation products of hormone synthesis which may be deposited in tissues.

It is confidently expected that these products will serve ultimately to aid the feeder as growth promoting factors. Questions posed, however, that involve human health as well as animal health should be answered before final endorsement of portions or all of recommendations that now go unchallenged.

Pasteurella Mastitis in Ewes

With the lambing season in full swing, we are receiving reports of Pasteurella mastitis of ewes, otherwise known as gangrenous mastitis, blue-bag, and pink-bag. The condition has been determined to be due primarily to infection with Pasteurella organisms. Secondary invaders are *Corynebacterium pyogenes*, Staphylococcus, and Escherichia. Usually only half of the udder is involved. The onset of this sporadic disease is usually shortly after lambing, when the udder is engorged and subjected to the vigorous nursing of a strong lamb. It has not been proved or disproved that the infection is transmitted from bed grounds where sheep have been bedded repeatedly. Nevertheless, annual change of lambing area is advisable, or at least its frequent disinfection. The disease sets in rapidly with evidence of an acute toxemia, high temperature, tenderness and pink discoloration of the half of the mammary gland affected. This is followed by gangrene and pus formation. Death within a few days, in untreated cases, is the usual sequel. Vaccination has not been successful. Injectable sulfonamides have been reported helpful in the early or "pink" stage, as has 400,000 units of penicillin administered intramuscularly.

Readers are referred to Pasteurella Mastitis in Ewes by Dr. E. A. Tunnicliff, Bozeman, Montana (*Vet. Med.*, 44:498 [Dec.], 1949) for complete discussion of the problem.

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New York Conference at Cornell

More than 600 veterinarians attended the 41st annual Veterinary Conference at the New York State College of Agriculture at Cornell University during the first week in January.

Closed circuit color television made possible direct demonstration of surgical technics to this large group, not possible by any other means. The color feature projected on one large screen was an improvement over black and white projection familiar to A.V.M.A. convention goers for the past four years.

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Although many cows recover from trichomoniasis after two or three months sexual rest, bulls seldom recover spontaneously.

Money Spent on Research is Investment for Gain

The following quotation is taken from an address by Dr. B. T. Simms, chief, Animal Disease and Parasite Research Branch, A.R.S., USDA, presented at the 58th annual meeting of the United States Livestock Sanitary Association, Omaha, Nebr., Oct. 10-12, 1954 as published in *The Federal Veterinarian*, January 1955.

"It has been estimated that diseases and parasites of livestock and poultry cost our country more than $2,500,000,000. annually. Funds spent to reduce this staggering amount should be considered as investments. If, by using a tax dollar, we can save the taxpayer $10. or a $100., the investment would, by all accepted standards, be considered a wise one. For example: We probably have at least 2,000,000 fewer cattle in our country with brucellosis today than we would have if control and eradication programs had not been undertaken; and we could have had no such program without research. These cattle are surely producing more than $25. each above what they would produce as Brucella-infected cattle. This means $60,000,000. annually; a big dividend on the money spent for research and eradication."

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Cervical Abscesses in Hogs

Abscesses in the region of the jowls in slaughter swine, of some considerable concern to packers, are now referred to as a disease entity.

Dr. J. R. Collier, Iowa State College, Ames, has conducted extensive research suggesting the cause as a specific streptococcal infection. Occurrence is widespread in some droves. Of 111 slaughter weight animals from one farm, 80 heads were condemned, according to *Livestock Conservation News*. This represents significant loss.

Information regarding the source of the disease, or its method of spread needs further study. Measures including depopulation, disinfection of quarters, et cetera, have not been favorable, according to Doctor Collier. Carefully planned management practices and clean pastures are recommended measures of control.

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Monkey kidney tissue is employed in sterile tissue culture for production of poliomyelitis vaccine.

Fermentation Products as Animal Feed Supplements

A number of antibiotics give comparable growth-promoting stimulation and disease-control effect when added to poultry rations at various levels. Fermentation products that contain the nutrient substances of the fermentation medium plus bacteria used as the inoculating agent, and products of fermentation have proved useful. An example is baciferm® (Commercial Solvents Corp., Terra Haute, Ind.) prepared from the whole fermentation beer. The inoculating agent is a pure culture of *Bacillus subtilis*. It is claimed that during fermentation, rapidly multiplying bacteria use the simple chemicals present and build them up into complex proteins. The protein content of baciferm is 37 to 38%, is of excellent quality, qualifying the product as a feed ingredient containing bacitracin. When fed at high levels (20 to 40 lb. per ton), significant values of the vitamin B complex are added to the ration with antibiotic content from 100 to 200 gm. per ton.

A number of disease complications common in large broiler and egg producing operations are reported to be controlled effecticely by either continuous baciferm feeding at low levels or high-level feeding for unlimited periods.

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Intercity Consultation via Television

Presentation of closed-circuit, color television for intercity consultation and diagnosis was a recent presentation of the Radio Corporation of America and the Columbia Broadcasting Company.

Pathologists at the University of Pennsylvania Hospital prepared a freshly removed tissue specimen for microscopic study of structure and color TV cameras picked up the microscopic view for transmission to pathologists in Baltimore and at the Naval Medical Center at Bethesda, Md.

Though imperfect now, practice and experience are expected to make possible consultation between widely separated authorities. —*S.N.L., Jan. 29, 1955.*

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It must always be remembered that the practice of veterinary medicine is a business, success in which is subject to certain definite laws which are applicable to every business. —*K. B. Haas, Sr., D. Ed.*

Humane Act Award

Nominations are invited for the Humane Act Award for 1955 bestowed annually by the A.V.M.A. on some boy or girl, not more than 18 years of age, in recognition of some act or acts which can be interpreted as kindness to animals. This might be a rescue or some project or activity worthy of such consideration. Anyone can make a nomination which should be forwarded with pertinent facts to the Humane Act Award Committee, A.V.M.A. 600 S. Michigan Ave., Chicago, not later than April 1, 1955.

Dr. W. A. Young, Western Regional Director, The American Humane Association is chairman of this year's Committee.

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Halogeton Poisoning

Under drought conditions, the cattle and sheep in the Southwest, are prone to turn to poisonous plants when range vegetation is scarce. Possibly standing at the head of the list, insofar as sheep are concerned, is halogeton, a plant closely related to the Russian thistle that made its first appearance in Nevada some 15 years ago. The toxic principal is oxalic acid. The plant, from six inches to two feet in height, does not do well in competition with other vegetation, but when such competition is absent it grows luxuriantly. Toxic effects of oxalic acid are due to its depressant action on the central nervous system and the heart. The outstanding clinical symptom following its ingestion is stupor. If found early enough, before too much absorption of acid has taken place, the correct treatment is the administration, by way of the mouth, of a calcium compound mixed with water in large and repeated doses. The combination of oxalic acid and a calcium compound forms insoluble calcium oxalate. One and one-half pounds of the dried halogeton plant is fatal to sheep. Four to six pounds are required to produce death in cattle.

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Iowa Veterinary Medical Association

Attendance at the annual meeting of the Iowa Veterinary Medical Association meeting in Des Moines on January 18-20, 1955 was 635 men and 252 ladies. New applications approved for membership were 75, bringing the total active membership of this association to 784. Dr. Frank B. Young, Waukee, is executive secretary of this pace-setting state association.

The Veterinarian's Wife

Almost 50 years ago, my father, one of the pioneer graduate veterinarians of Iowa, took me with him to a combination meeting and large animal clinic at Council Bluffs, Iowa.

The contrast between our state meetings and annual A.V.M.A. conventions now and those of half century ago is amazing. Now, in the same state of Iowa, 80% of veterinarians in attendance at the annual meeting are accompanied by their wives. This percentage approximates that of other state associations.

Many things have contributed to the "coming of age of the veterinary profession in America", but, having seen the panorama of our profession's life over the past half century, I harbor the firm conviction that integration of the D.V.M.'s wives into organized veterinary medicine is possibly the most important of all these contributory factors.

To say the least, the veterinarian's wife who attends meetings with him, who broadens her friendships in state, local, and national auxiliaries, who gets a closer view of the history, accomplishments, problems and perspective of her husband's chosen calling, finds life richer, happier, and possessed of a closer bond of marital understanding.— *A. H. Quin, D.V.M. from The Maine Veterinarian, January 1955.*

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Veterinary Student Enrollment

Veterinary student enrollment in 17 schools in the United States and two in Canada for the academic year 1954-1955 as tabulated (*Jour. Am. Vet. Med. Assn.*, 125:495 [Dec.], 1954) reveals a total of 3,732 undergraduates matriculated in the professional curricula, exclusive of preveterinary students. Adding 22 specially classified and 139 graduate students, a grand total of 3,893 is now in school, from which 901 will graduate at the close of the spring semester. This number represents a change of only ten additional students over enrollment of one year ago.

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Contagious ecthyma of sheep is transmissible to man. Several workers have reported vesicles in the mouth and on the hands and arms of infected persons. Infection is mild and not ordinarily serious. The disease is endemic in many areas of the west where large bands of lambs are fed for slaughter.

PRINCIPLES OF ANIMAL HEALTH

R. R. DYKSTRA, D.V.M.
Manhattan, Kansas

Formula for Spinose Ear Ticks

The 1953 Report of the Chief of the U. S. Bureau of Industry contains a formula for an improved spinose ear-tick remedy. It consists of 5 oz. kerosene, 10 oz. crude cottonseed oil, and ¾ oz. of a 20% emulsifiable lindane concentrate. The material was applied, we assume, after mechanical removal of as many ticks as possible with a wire loop. The mixture was then applied by means of a small garden sprayer equipped with a smooth, round tip about one-half inch in diameter. Dose recommended is ½ oz. per ear, per animal. Twenty gallons was needed to treat 2,500 animals. The small number of live ticks found at the end of 30 days in a few animals indicated that spray was improperly applied or insufficient quantity was used in these.

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Stilbestrol Feeding for Fattening Cattle

Stilbestrol (diethylstilbestrol) a synthetic sex hormone, not related to any of the natural estrogens, is claimed to be ten times more powerful in its action than estradiol (estrone). The natural estradiol is obtained usually from the urine of pregnant mares, and to a lesser extent from liquor folliculi of swine ovaries. Most recently attention has been called to stilbestrol for the feeding of beef cattle. Veterinarians have used this hormone for some years for the production or stimulation of estrus. It has also had wide use for its feminizing influence on male fowl. Practitioners are familiar with the potency of this agent. In the feedlot, favorable stimulation for growth and live-weight gains are claimed. However, the ration also must contain normal factors of a well-balanced ration such as proteins, minerals, vitamins, unidentified factors, et cetera.

Under no circumstances should stilbestrol-containing feeds be fed to dairy cattle or beef cattle used for breeding purposes; nor have they as yet been approved for swine, sheep, or poultry. In general, the daily dose for cattle is from 5 to 10 mg. for animals weighing from 600 to 1200 lb. Because of the potential danger in over-dosage in the hands of uninformed and inexperienced persons, a commercially prepared "premix" has been authorized which contains 10,000 mg. stilbestrol incorporated in 10 lb. of soybean meal and vegetable oil, all of which is to be added and thoroughly mixed in 2,000 lb. of cattle supplement. Each pound of the supplement contains 5 mg. of the active ingredient. Fed in this manner, and in these dosages, nutritive properties of the feed consumed by beef cattle is enhanced so that more rapid, lower cost gains result. From the human health standpoint, no detectable residues have been identified in the meat of stilbestrol-fed cattle. Carcasses receive the same financial consideration on markets.

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Mucosal Disease

Mucosal disease of cattle is still an unsolved problem. The most outstanding symptoms are bloody diarrhea, straining, and lachrymation. A common lesion is ulceration of the alimentary tract. The disease bears some resemblance to the virus diarrhea of calves (Olafson), to hyperkeratosis, and malignant catarrhal fever. It does not appear to be contagious, though one researcher reports ulceration in a recipient following the inoculation with a large volume of blood derived from an ailing donor. Vitamin A, as an etiological factor, definitely has been eliminated. Treatment recommended now is symptomatic. Emphasis is placed on observance of sanitary measures for control.

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Cerebral Hemorrhage Due to Ox Warble

The larvae of *Hypoderma bovis* (ox warble) almost invariably completes its migration in the animal's body to the subcutaneous tissue of the lumbar region. Occasionally a migrant larva loses its way as indicated in a report of the death of an animal from brain hemorrhage due to a wandering warble that had lodged in the brain.

VETERINARY PARASITOLOGY

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Cattle Grubs Killed by a New Organic Phosphate

Despite continued trials with various chemical agents, including many chlorinated and organic phosphorus insecticides, rotenone has remained unsurpassed for the destruction of cattle grubs[1]. It is noteworthy, therefore, that one of the newer insecticides, unhappily designated as "21/199", is reported to be an efficient grub killer. In preliminary trials, according to a recent statement[2], all of 245 grubs in the backs of nine cattle were killed in a week by a 0.5% spray. Chemically, "21/199" is 3-chloro-4 methylumbelliferone o, o-diethylthiophosphate. The promise discovered in this compound and the currently suggested action of free-choice phenothiazine[3] are the greatest strides that have been made experimentally in the field of warble control since the advent of derris washes.

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Dieldrin for Sheep Scab

One dipping in a suspension of dieldrin wettable powder at 0.03% concentration of the active ingredient, according to South African workers[5], promptly cured advanced, active cases of common sheep scab. The authors observed that gamma BHC is the acaricide of choice against psoroptic mange of livestock, despite the impressive list of new synthetic insecticides, but they found little to choose between this and dieldrin. They used a suspension of wettable BHC powder at 0.02% concentration of the gamma isomer. It will be recalled, in passing, that the present recommendation of 0.06% in the United States is considerably above the minimum that effected complete eradication experimentally[7] and is higher than that which has been used so successfully in Great Britain since 1948. In British practice, dips are prepared at a minimum of 0.016% gamma BHC and replenished with 0.024% (if emulsion type) or 0.02% (if suspension type); the minimum effective strength is regarded to be as little as 0.005% gamma BHC. It should be noted, moreover, that a recent review[8] of the study in question erroneously stated that the South African veterinarians used an "emulsion" of dieldrin and a 0.05% concentration of gamma BHC.

Although the dieldrin preparation was not made into a suitable suspension as readily as the BHC powder, both these compounds showed the desirable property of diffusion along the wool fibers that is essential to rendering animals "parasite-proof". Aldrin, although possessing this property, was comparatively ineffective.

Previously[4,5], the authors had found that both aldrin and dieldrin prevented blowfly strike, and tests described currently by them[6], using isodrin and endrin, compare favorably, although the latter compounds were regarded as unsuitable for application to sheep because they bleach the wool and cause structural changes in the staple.

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Aqueous extracts of dried fish tapeworms, *Diphyllobothrium latum*, were found by Scandinavian workers[9] to effect a prompt cure of pernicious anemia. The blood picture of five patients, four of which were infected with the tapeworm, rapidly returned to normal following intramuscular injections of the extracts. It is reasoned that the parasite contains larger amounts of vitamin B_{12} of which it has robbed its host. See *Vet. Med.*, 48:465 [Nov.], 1953).

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ABSTRACTS OF LITERATURE

Foot Rot in Sheep

The term "foot rot" in sheep is reserved for the designation of a specific transmissible and infectious disease of the claws. It differs in some aspects from the anomaly seen commonly in cattle, especially dairy cows[9].

Characterized primarily by lameness in one or more feet, this condition is restricted to the claws. The coronary band and tissue above it are not involved. Initially the lesion is a tenderness and reddening on the medial surface of the digit or surface necrosis of the softhorn. Moist necrosis of the bulb of the heel and of the digit are followed by extension in the corium to the extent of undermining the entire sole. Horny wall also separates, resulting in chronic cases of deformed hooves. The authors have not observed cases where the infection invaded joints and ligaments.

Experimental infection was produced by placing sheep on wet pastures or lot in which infected sheep were held. Brief drying of these renders them innocuous though *Spherophorus necrophorus* may be isolated by careful culture of the soil. Extreme wet conditions do not, in themselves, cause the appearance of foot rot. The only source of infection is infected sheep.

Treatment involves individual handling of all animals and radical trimming to remove necrotic tissue, then forcing animals through a saturated copper sulfate (30%) solution. One treatment ordinarily suffices. Control by pasture rotation is recommended as practical management because of the observation that premises rapidly lose their infectivity.

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Cuds for Calves

Cud transfers from healthy, good-doing cows seem to be a practical method for helping calves develop normal digestion[10]. Separation of calves and older stock, as practiced most conscientiously on dairy farms, often prevents the calf from acquiring a normal rumen population of bacteria and protozoa, which help break down and digest the cellulose of roughage.

The cud transfer technic is as follows: Stand on right of cow; pass the left arm across the cow's face just after she brings up a fresh cud; grasp the upper left lip and extend fingers of the left hand into her mouth, causing her to open mouth; lift out cud material with right hand. Thereafter place small pieces of this cud material into back of calf's mouth. Repeat this procedure several times during first two weeks of calf's life.

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Chemical Composition of Urinary Calculi

A striking observation is reported by Swingle[9] revealed by extensive investigation of the chemical composition of concretions occluding the urethra of range cattle. He reports "universal appearance of protein and silicon". One-third of stones collected appeared to contain nothing but protein and silica, and some others only traces of other components.

The author states that, "Bovine urine normally contains 50 to 150 parts per million of soluble silica and also considerable quantities of mucin." It was concluded therefore, that these stones were made up of mucoproteins. Other proteins, such as albumin, have not been observed in urine of steers in which occluding calculi have been demonstrated.

Seasonal nature of calculi formation among range steers suggest a nutritional factor or factors and vitamin A deficiency. Attempts to produce calculi by limiting water consumption failed.

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Quarantine might be described as a gallant effort against insurmountable odds, to limit prevalence of a disease geographically for a relatively brief time.

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The first Longhorns were brought to America in 1521 by Gregorio Vallalobos, a governor-general sent to "New Spain".—*S.N.L.*

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PUBLIC HEALTH

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Leptospirosis

In 1928, Fletcher[1] presented an interesting account of leptospirosis in the Malay States. Following this report Manson-Bahr commented on his description of the variability of leptospiral diseases stating, "Dr. Fletcher has given us almost every possible variation between ill-defined fevers of all sorts and leptospirosis and one wonders where this is going to end." This statement seems as appropriate today as it was nearly 30 years ago, for many questions regarding the leptospiroses remain unanswered. Although Leptospira were first observed in tissues from a human case of disease by Stimson[2] in 1907 in New Orleans, only in recent years has significant progress been made in investigations of leptospirosis in the United States. Is it an insidious infection as suggested by Broom,[3] which has appeared gradually and become established almost unnoticed or has it been present all these years and gone undetected largely because of the masking symptoms and difficulties associated with laboratory diagnosis?

Reinhard[4] is of the opinion that an indifferent attitude existed in this country which was supported by the belief that leptospiroses were tropical diseases and occurred only sporadically. Certainly, this was not true of investigators in Europe, Asia, and Australia, who have made many worthy contributions to our knowledge of these diseases.

The first human cases of *L. canicola* infection in the United States were reported by Meyer and his associates[5,6] in 1938, and the dog was found to be the reservoir of this infection. A few years later Jungherr[7] in Connecticut found Leptospira in the tissues of cattle and Baker and Little[8] isolated *L. pomona* from an outbreak in dairy cattle in New Jersey. These reports stimulated considerable interest in both the medical and veterinary profession and recognition of leptospirosis in man and animals increased notably. The clinical symptoms produced by the different leptospiral serotypes may be closely similar. Thus the importance of the cultural and serological laboratory procedures increases.

Unfortunately the special physical properties and growth requirements of Leptospirae necessitate special tedious technics which are not readily applicable for the average diagnostic laboratory. Thus only a limited number of laboratories offer diagnostic service. This fact has delayed progress considerably. A review of the literature relative to the laboratory diagnosis of leptospirosis reveals a horde of recommended serological tests both complement fixation, with antigens prepared by a variety of methods, microscopic and macroscopic agglutination with preserved antigens, agglutinations-lysis, with living antigens, and hemagglutination. Differences in technics employed in various laboratories make comparison and evaluation of results difficult. There is obviously a great need for standard methods of laboratory technics and typing procedures, if we expect to determine the prevalence of human and animal leptospirosis and in so doing the public health importance of the disease. At the Fifth International Congress of Microbiology, 1950, Dr. J. W. Wolff[9] suggested international cooperation in establishing standard methods which resulted in the nomination of a Leptospiral Subcommittee to study these problems. Recognizing the lack of a standard readily performed diagnostic test and the need for a better definition of Leptospira serotypes, the World Health Organization[10] is assisting in the development of stable killed antigens suitable for use in public health and veterinary diagnostic laboratories and encouraging further research along these lines.

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Feline Ringworm — A Public Health Problem

An outbreak of ringworm caused by *Microsporum canis* occurred recently among Persian cats at a breeder's home. During the investigation 40 cats and one dog were examined with the Wood's lamp, and hairs from each animal were studied microscopically and cultured. Although *M. canis* was isolated from all of the animals, only 59% had visible lesions; 32% exhibited fluorescence. Only 29% were found to be positive upon direct microscopic examination of the hair. It was apparent from these results that cultures were the only definitive way to establish diagnosis.

The owner of the cats had had lesions typical of *M. canis* infection on her person. She had noted skin lesions on her cats for the past four years. She had observed that each new lot of kittens became infected shortly after birth. In our study, *M. canis* was isolated from 4 to 18-day-old kittens. Since the owner had been selling infected cats for at least four years, it is reasonable to assume that this establishment had functioned as a source of *M. canis* ringworm outbreaks in the city.

Feline ringworm has been found to be an important source of *M. canis* ringworm in man. Several small outbreaks have occurred during the past year which involved from one to 16 human beings. The majority of the outbreaks were caused by cats under one year of age.

Recently a stray kitten with skin lesions wandered into a neighborhood in a southern city and caused an outbreak of *M. canis* ringworm which involved four women, 12 children and three dogs. All but one of the human cases had handled the kitten. The one exception was a three-month-old baby who had been infected by contact to one or both of the siblings.

It would appear that both the stray and the pure-bred cat are involved in the transmission of ringworm infection to man. Effective control of certain types of human ringworm infections can not be carried out without veterinary mycological studies.

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